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STATE LIGHTING COMMISSIONS.

The New York State Lighting Commission has been organizing this week, and will soon be dealing with the work that awaits it, and that has been accumulating for some months. It is needless to say that the manner in which this body will approach and execute its duties is a subject of deep interest to the lighting corporations doing business in New York State as well as to the electric lighting industry in general. A short time ago we presented a synopsis of the law forming the Commission and showing the respects in which it differs from the kindred Massachusetts law. As our readers are aware, the New England body has been at work for some years—its twentieth annual report was issued this year—so that a long interval occurred between the initiative work there and the imitation of it in New York. The attempt has been made now to improve on the older law and practice. It is hard to own up the results in New England, although we propose soon to make an effort to summarize its leading features. A difference of opinion exists as to these results. We know that among Massachusetts electric light and gas managers a feeling prevails that the law has not protected them as they expected against undue competition and injurious rate reductions. On the other hand, some people in the State allege that it has been extremely hard to beat down the barriers that the Commissio has put up against new competition, so that the old companies have been entrenched and fortified in their position by the law, and have had a virtual monopoly created. The real truth probably is that the Commission has done good work for the public, and a steady perusal of its reports and documents throughout the whole term of its existence inclines us to believe that such is indeed the case. It will now be the turn of the New York commission to focus attention and to show how well it can administer the delegated powers of the State and build up on broad foundations of equity proper relations between the corporations and the public.

GOVERNMENT ELECTRICAL CONTROL.

An illustration of the manner in which the electric lighting industry of Great Britain has been trammeled in the past, and even at the present time, by government control, is afforded in proceedings now under way to obtain consent for a change of the voltage of a London central station service. Until 1896 no change could be made in a house supply pressure without the consent of every consumer; so that no matter how great the advance in the art which involved a change of voltage, a single consumer could veto adoption of the improvement. In 1901 this regulation was modified in two respects: First, the central station in the case of non-assenting consumers connected prior to 1896 has the right of appeal to the Board of Trade, and upon appeal that body is required to appoint an arbitrator; and second, in the case of consumers connected subsequently to 1896, the change in pressure has to be sanctioned by the London County Council. In the present instance, out of 1,700 consumers connected to the service prior to 1896, some 40 consumers have refused their consent to a change of voltage to 200 volts, and as a result proceedings in arbitration have been instituted and are now under way. This is only one example of numerous regulations which have tended to hamper so seriously, not only the electric lighting but also the electric railway industry, in Great Britain. If in this country the electrical industry during its period of development had been similarly trammeled by government regu-

lations, we would probably at present be lingering under conditions now considered archaic. Curiously enough, the public is, at least in the case of an art under rapid development, almost inevitably the victim of governmental restrictions, for its members are not only deprived of the benefit of ameliorations, but also of the decreased cost of service almost invariably incident therewith.

The Memory of Franklin.

Next January 17 will be celebrated the two hundredth anniversary of the birth of Franklin, and steps are already being taken to make the occasion an interesting one, particularly in Massachusetts and Pennsylvania. We are glad to understand that in such exercises as may take place the American Institute of Electrical Engineers and the New York Electrical Society—the oldest body and the national body—have been invited to assist. Franklin was not only one of the fathers of the Republic, but one of the founders of modern electricity. His fame and glory as an electrician have been lessened by his wider claims to recognition, but the fact remains that Franklin will always hold a high and distinct place in the history of the science. Next year it will be timely for electrical engineers to refresh their memories as to his work, to review his theories and researches, to note what definite progress has been made since his day, and to place fresh laurels on his serene philosophic brow.

Progress in Electric Heating.

Any one who heard the discussion on the status of electric heating at the last N. E. L. A. convention could not but feel that gratifying progress is being made in the introduction of electric heating devices by the more enterprising central stations. While it is generally true that the high cost of operating electric heating devices as compared to doing the same work with gas or coal has kept down the use of such appliances, the great convenience of electrical heat has outweighed the cost in many instances. Furthermore, there is a constant downward tendency of prices charged for current by central station companies. Every reduction in price means that much greater chance to introduce electric heating. The figures cited by some of the members from actual experiences on the cost of ironing by electric heat were probably a surprise to many and led to recognition of the fact that electric heating is to be reckoned with in the future possibilities of the central station business. During the N. E. L. A. discussion on this subject, the importance of central station men themselves installing and using in their own homes all types of electric heating devices was emphasized, that they may know from actual experience how the costs will run and just what can be done with these appliances. There is no better way for central station men to familiarize themselves with this business and to come to a realizing sense of its advantages in a way which will cause them to talk it up enthusiastically to a customer, than by thus having these appliances in their own homes. We fear that it has been too often a case of the shoemaker's wife going without shoes.

Soulless Corporations.

We printed last week an abstract of the report of the Merchants' Association of New York on its telephonic investigation in this city. The report pointed out that while the reductions in rates called for by its committee amounted to at least $1,000,000 a year, the New York Telephone Company not only acquiesced in this as it had agreed to do, but has carried out a rate policy involving a reduction of $1,525,000. We have not seen any commendation of this liberality in the daily papers, although there may have been. Perhaps the papers think that the policy is dictated by shrewd self-interest; but even from that point of view it seems worthy of notice.

At any rate we desire to signalize it, and while doing so to direct attention to another piece of kindred liberality in this city by a large electrical corporation, which has certainly not been overburdened with praise in the public prints. The New York Edison Company has put in force the legislation compelling it to reduce the price of current to ten cents per kilowatt-hour. This means a reduction of income of at least $1,000,000 a year, but in spite of that the company is continuing its policy of furnishing free arc lamp supplies and all incandescent lamp renewals. No legislation could compel this, for while rates may be regulated, neither the constitution nor the courts recognize laws that would force a man to give up actual, real, tangible goods without any "consideration." But the New York Edison Company in announcing a rate of 10 cents for light and one of 7½ cents for power current, throws in these accessories and necessities free gratis. Once again, it might be contended that this is only enlightened self-interest, but whatever else it may be, it far outruns the dictates of the law, and gives the public much more than the Legislature sought to exact in its behalf; and we are glad to commend and distinguish such an action.

A Field for Investigation.

The electrically-driven automobile has not yet taken the prominent place which its friends would wish for it, but nevertheless the automobilist is generally painfully dependent upon the electrician. We believe that the modern machine in spite of all attempts to simplify it and to render it reliable, still shows itself capable of supplying more diabolical surprises to its operator than anything else of human contrivance. And not a little of its infinite resource comes from the sparking devices. As a source of current about everything in the electrical armory has been tried from dry batteries stuffed with old newspaper, like one we once dissected, to direct-connected alternators. We have communed and condoled from time to time with the users of all, and have reached the conclusion that at the end of a season one always wishes he had tried the other kind. And quite apart from the source of current stands the spark coil, which no one but the second mate of a coaster seems able fittingly to characterize. Now there are unquestionably very good as well as very bad sparking arrangements, and when the good ones are ill-used and the bad ones well used there is often little to choose between them. The chauffeur generally knows about as much of electricity as he does about Aztec picture writing, and when things go wrong there is the deuce to pay.

It is high time that the subject were taken up in its entirety and thoroughly investigated from every standpoint of view. The problem is to secure steady and reliable sparking with the minimum complication and waste of energy. The parts of the apparatus may be well made individually, but unless they are skillfully designed to work together the results will be very different. To begin with, something ought to be known regarding the actual e.m.f. and energy required to explode the charge with a given spark-gap under the most unfavorable circumstances reasonably to be expected. Then the coils should be designed to furnish the energy with the maximum efficiency, and should be definitely marked with the primary e.m.f. required and the working current which should not be exceeded. At present precious little is known about the nature of the demand for primary energy, much less of its amount with different spark plugs and under different circumstances. In particular, data should be accumulated showing the watt-hours and ampere-hours

required with a given coil and plug, let us say per million sparks. In other words, the rate of working required from the source should be definitely known for the ordinary standard coils and plugs. This cannot be told by guessing, but it is strictly determinable. These data once accumulated, it should be an easy matter to design a proper source of supply. As it now is, the coils have to be designed without accurate knowledge of the requirements, the plugs are made without any reference to the coils and both are supplied from any source that comes handy. Consequently nobody knows what is the best thing to do, or what performance to expect or to demand from batteries or sparking dynamos. And naturally there is an indefinite amount of trouble from sparking apparatus.

It is not enough that sparking should be powerful and regular without undue call for energy or deterioration of the contacts. The facts can be ascertained and they are just as necessary to correct design of the equipment as is the output required of any other electrical apparatus to its proper proportioning. It should then be entirely possible to say definitely what duty can reasonably be expected of a given battery, and at what output or under what conditions it is advisable to use a special dynamo. And if batteries are to be tried, then of what characteristics? We are disposed to think that with a proper understanding of the conditions ignition could not only be rendered completely reliable, but could be accomplished at a greatly reduced expenditure of energy, and hence with a minimum of trouble and expense. Some of our engineering schools could well undertake the investigations necessary to place the subject upon a scientific basis, and it is surely a more important and interesting study than most of the current topics for theses. The apparatus required would be merely a typical automobile engine mounted for steady running and the ordinary instruments available in a good laboratory, and the only difficulty would be that due to the diversity of conditions under which experiments should be made —at different speeds and compressions with different loads and different grades of gasoline. We have no doubt that automobile manufacturers would be glad to co-operate by supplying the necessary engines, and the sparking apparatus makers likewise. These latter are anxiously striving to put out good material, but they have to work very much in the dark at present. Certainly, the automobiling fraternity will be deeply indebted to any one who can gather the data for the solution of the ignition problem, which is ever present and just now pretty badly muddled.

INTERNATIONAL COMMISSION ON ELECTRICAL UNITS AND STANDARDS.

We are very glad to learn that the Elektrotechnische Reichsanstalt has called a conference, as a preliminary to the meeting of the International Commission of Electrical Units and Standards. This is in line with the recommendations of the International Electrical Congress of St. Louis, which urged, as the outcome of its deliberations, that the differences which existed in the laws relating to electrical units or their interpretations, should be considered by an international commission. The preliminary conference will be held in Berlin about the end of October next, those invited being the heads of the government electrical bureaus in America, England, Belgium, Austro-Hungary and France, besides several other prominent electro-physicists, among whom is included Prof. H. S. Carhart. The essential point to be hoped for as the result of the work of such an international commission would be a permanent channel of communication between the various government electrical bureaus whereby the concrete standards of electromotive force, resistance, current and capacity may be maintained uniform within the limits of appreciation of commercial laboratories. The concrete standard volt as maintained at the National Bureau of Standards in Washington, the Board of Trade Laboratory in London, or the Reichsanstalt in Berlin, should be the same to at least one twenty-fifth part of one per cent., and, if possible, to one-fiftieth of one per cent. The concrete standard ohm as kept at the same institutions should be uniform among themselves to at least one-fiftieth of one per cent., and, if possible, to one-hundredth of one per cent. If these two concrete standards are kept in accord, to the desired degree of uniformity above mentioned, of one-fiftieth and one-hundredth of one per cent, respectively, then the ampere as preserved by reference to primary standard electrogravity balances will have to be within at least one thirty-third of one per cent among themselves in order to check with their local volt-ohm standards.

Every one will admit that it is of much greater importance for industrial purposes that the concrete standards of the national bureaus of the different countries should be in agreement with each other to commercial limits, and all in error by a reasonable amount, than that one set, say those at Paris, should be rigidly correct, but the others not quite in conformity therewith. This is for the same reason that in dealing wih the international metre, we all seek for concrete standards of length that shall be as nearly alike in the different national bureaus as it is practicable to copy or reproduce them, even though all are a little short of the original geodetic definition. This is industrially of much greater importance than to have one nation with a metre which should be hypothetically accurate according to definition, but the other national metres slightly differing therefrom. At the present time the volt of America as determined according to United States laws, following the recommendations of the Chicago Congress, is nearly one-tenth of one per cent smaller than the volt that is standard in the official electrical bureaus of some other countries. Although the great bulk of engineering operations would regard this discrepancy as trivial and ignorable, yet it is a discrepancy that becomes commercially appreciable in dealing with devices so sensitive to voltage as incandescent lamps. Moreover it is a discrepancy that is readily appreciable upon the scale of any good laboratory standard voltmeter. Such a discrepancy is unworthy of the development attained to-day either by electrophysics or by electrical engineering. Any such error tends to perpetuate itself indefinitely, by permeating disadvantageously all kinds of standard physical determinations based upon electrical units.

We hope that ultimately there may be a permanent international commission on electrical units, so related to the various national bureaus that, at stated intervals, concrete standards may be circulated among the latter for direct comparison with those in service, in such a manner that no appreciable discrepancy between the ohms, volts or of different countries can ever arise. In this way a certificate from any one national bureau, such as the Washington Bureau of Standards, issued upon a first-class standard measuring instrument, would convey, by implication at least, the authority of the international electrical commission. Our units are called international electrical units. Their name should be made good by the appointment of an international commission to determine that they are really international. Without such supervision the units tend to become degraded from an international to a national basis, except as the national bureaus may be able by sporadic effort to do individually, and at much effort, what a central commission should accomplish universally and with minimum effort. A permanent international electrical commission, dealing with electrical units, would form another bond of union between civilized countries tending to bring them nearer together in ideals, in purposes and in accomplishment.

Telegraph and Telephone Arrangements at the Peace Conference.

Complete facilities for the handling of telegraph and telephone messages in connection with the Russo-Japanese Peace Conference have been prepared at Portsmouth, N. H., by the Western Union Telegraph Company, the Postal Telegraph-Cable Company, and the New England Telephone & Telegraph Company. The large amount of press matter and the official communications anticipated between the envoys and their respective governments called for unusual means of handling the situation, and on Saturday, August 5, two days before the arrival of the Russian and Japanese plenipotentiaries, the arrangements were practically finished.

Both the Western Union and Postal Companies have established auxiliary telegraph and cable offices at the Hotel Wentworth, Newcastle, the hostelry which will receive the envoys as guests. The Western Union office is equipped with four quadruplexes, three duplexes and eleven single loops, besides special private loops in the Japanese and Russian suites, where direct communication will be maintained with the Atlantic cables at Heart's Content, Newfoundland via Canso, and also with the Western Union offices in New York, whence the Japanese diplomatic matter will be sent via land lines to San Francisco over a direct circuit. This circuit will be maintained during the night and early morning hours via Chicago, Omaha and Ogden, Utah. From San Francisco messages will be transmitted via the Pacific cable through Honolulu, Midway, Guam, Manila and Hong Kong to Japan. Facilities for the work of 25 extra operators are available at the Hotel Wentworth, which is connected by direct wire with the Halifax-Rye Beach cable station at Rye Beach, N. H., as well as with the land lines of the Western Union Company. The bulk of the Western Union work will be focussed upon the company's main offices on Daniel Street, Portsmouth, which are connected with the Hotel Wentworth by a temporary aerial cable of 19 wires. An extra office, largely for the use of newspaper correspondents, has been set up in the Elk's Hall opposite the main office on Daniel Street. About 1,500 cells of gravity battery are installed in this building and 25 extra operators can be put at work if necessary, besides 15 operators in the main office. Two special circuits for the use of the envoys and their staffs have also been installed between the Portsmouth Navy Yard and the main office.

The Postal Telegraph-Cable Company's arrangements correspond closely to those made by the Western Union. An auxiliary office at the Wentworth with four quadruplexes, three duplexes, ten single loops and private loops to the envoys' suites is installed, the hotel being connected with the main office on Congress Street, Portsmouth, by a 22-wire aerial cable about 3½ miles in length. All the Wentworth service is looped through this main office, which is connected by direct wires with the Postal and Commercial Cable offices in New York. Russian messages will probably pass via the Commercial cables through Canso and Japanese via the Postal Telegraph land lines to San Francisco and thence via the Pacific cable, which the company controls, to Hong Kong and Japan. In the main office at Portsmouth, under Manager G. E. Morrill, tables with writing facilities have been prepared for the convenience of despatch senders, and this office contains the company's famous "portable quads," which are transported from place to place in order to meet emergency calls, and also three 1/16-kw portable dynamos mounted on boxes equipped with rollers. These dynamos are supplied with 125-volt, direct current from the Rockingham County Light & Power Company's station in Portsmouth and are designed for 115 volts primary and 380 volts secondary current. Fifty extra operators can be accommodated if necessary at the Postal offices and two navy yard circuits are also in place for Postal service.

The New England Telephone & Telegraph Company has doubled its trunk line facilities between Portsmouth and Boston, making a total of eight circuits available. It has also placed in commission one special toll circuit between Portsmouth and Worcester, Mass., for New York and Washington traffic. Two additional recording operators are ready for business at the Portsmouth central offices, an additional station has been set up at the Hotel Wentworth and three extra stations at the Navy Yard for the exclusive use of the conference. The large use of these facilities by the press is already indicated in the copious news dispatches in the great dailies.

Programme of the Ohio Electric Light Association Meeting.

The eleventh annual meeting of the Ohio Electric Light Association is to be held at Hotel Victory, Put-in Bay, on August 16, 17 and 18, for which an admirable programme has been provided of papers and entertainment. The regular sessions will begin at 9.30 a. m., Wednesday, August 16, and the programme will be substantially as follows: First session—President's address; "Central Station By-Products," J. A. Bendure, Lima; "Notes on Use of Barriers in Alternating-Current Switchboard Construction," H. L. Wallau, Cleveland; "Mercury Arc Rectifier," P. D. Wagoner. Second session, 2 p. m.—"Effect of Large Alternating-Current Motors on Plants of 1,000 Kilowatts and Less," E. H. Best, Youngstown; Leo Phillips, New York City; "Electric Motor Applications," J. Henry Flinck, Pittsburg, Pa.; "Conditions Under Which It Has Been Found Advantageous to Use Potential Regulators," W. E. Richards, Toledo.

Thursday, Aug. 17.—First session, 9.30 a. m.—"Pole Line Construction," B. L. Chase, Columbus, Ohio; E. E. Noble, Cleveland; report of committee on "Cost Determination," E. J. Bechtel, Toledo, Ohio; M. C. Hull, Columbus. Second session, 2 p. m.—"Methods of Selling Current as Applied to Cities of 20,000 Inhabitants," H. C. Ayers, Greenville; "Methods Employed in Getting New Business and Retaining Present Business When Gasoline and Natural Gas Competition Exists," W. E. Russell, Massillon; R. L. Johnston, Akron; J. R. Maxon, Gallipolis.

Friday, Aug. 18.—First session, 9.30 a. m.—"Wiring Moderate Size Residences," J. Kermode, Cleveland; "Meter and Billing Records," F. E. Valentine, Piqua; D. W. Low, Alliance; C. E. Inman, Warren; George Hayler, Joplin, Mo.; election of officers. Second session, 2 p. m.—High Efficiency in Lighting Units—"The Tantalum Lamp," William Ambler, Cleveland; "The Nernst Lamp," E. R. Roberts, Pittsburg; "High Efficiency High Candle-Power Incandescent Lamps," F. W. Willcox. Question Box. Third session, Friday evening—Illustrated lecture on "Illuminating Engineering," W. D. O'Ryan, Lynn, Mass., followed by banquet.

A Municipal Ownership Investigation.

The National Civic Federation has appointed a commission to make an investigation in this country and Europe of national and municipal ownership and operation of public utilities. A statement made on behalf of the Civic Federation on the subject of the appointment of the commission says in part:

"The scope of this inquiry will cover the relative advantages of public ownership and operation as compared with private ownership and operation. Each system will be examined with regard to its effect upon, among other topics, wages, hours and conditions of labor, collective bargaining, cost and character of service, political conditions, civil service, spoils system and municipal corruption, financial results, taxation."

The commission will meet early in the fall to arrange upon a plan of operation. Among the members are:

New York City—Isaac N. Seligman, John G. Agar, president of the Reform Club; Oscar S. Straus, Frank A. Vanderlip, Albert Shaw, Robert W. De Forest, Austen G. Fox, Timothy Healy, president of the International Brotherhood of Stationary Firemen; Prof. E. R. A. Seligman, Prof. Frank J. Goodnow, Prof. Alexander C. Humphreys, William J. Clark, of the General Electric Company; Hamilton Holt, editor of the *Independent;* Laurence F. Abbott, editor of the *Outlook;* R. R. Bowker, of *Publishers' Weekly;* M. R. Maltbie, T. C. Martin, editor of the ELECTRICAL WORLD AND ENGINEER; Edward A. Moffett, Charles A. Conant, V. Everit Macy, Marcus M. Marks. Boston—John F. Tobin, president of the Boot and Shoe Workers' Union; James Duncan, secretary of the Granite Cutters' National Union; Prof. F. W. Taussig, P. F. Sullivan, Charles L. Edgar, Louis D. Brandeis, Frank Parsons, James F. Jackson, F. E. Barker. Chicago—Franklin MacVeagh, Alexander H. Revell, Walter L. Fisher, Samuel Insull, Graham Taylor, E. B. Smith, George E. Hooker, George C. Sikes, Slason Thompson. Cincinnati—Melville E. Ingalls, John P. Frey. Indianapolis—S. M. Sexton, Alfred F. Potts, John Mitchell, president of the United Mine Workers; George F. McCulloch, John F. McNamee. Phila-

delphia—Prof. Leo S. Rowe, Walton Clark, Talcott Williams. Miscellaneous—W. D. Foulke, of Richmond, Va.; Edward Rosewater, of Omaha; Charles W. Knapp and Frederick N. Judson, of St. Louis; C. H. Salmons, Horace E. Andrews, D. L. Cease and Edward W. Bemis, of Cleveland; H. W. Goode, of Portland, Ore.; Samuel Gompers, president of the American Federation of Labor, and P. F. McNulty, of Washington; Thomas Lowry, of Minneapolis; J. C. Hutchins and Daniel J. Keefe, of Detroit; E. E. Clark, Cedar Rapids, Iowa; Prof. J. W. Jenks, of Cornell; Prof. Henry W. Farnham, of Yale; Prof. Carroll D. Wright, of Worcester, Mass.; Prof. J. R. Commons, of Madison, Wis.; Prof. Henry C. Adams, of Ann Arbor, Mich.; Prof. J. H. Gray, of Evanston, Ill.

A Criticism of the Detroit Municipal Lighting Figures.

It has been the custom of the ELECTRICAL WORLD AND ENGINEER to make an annual review and critique of the report of the Detroit Municipal Lighting Commission. In this intention for the current year, we are, however, anticipated to some extent by the *Michigan Investor,* and we give below its pertinent discussion of the subject:

"The Public Lighting Commission of the city of Detroit has just made public the results of its operation for the year ending June 30, 1905. It appears from the deductions of Secretary Bowler that, whereas, during the year 1903-1904 the public arc lights of Detroit each cost $40.16 per year, during the year just closed the cost per lamp has been reduced to $34.99, a claimed saving of $5.17 per arc lamp. If the price of producing electric light for the city of Detroit continues to be reduced at this rate, it will be brought down to nothing in 6 years and 281 days. This may be a bit optimistic, but it is the only deduction that can be reasonably made from the queerly made-up reports, with which the lighting commission deceives the public of which it is the servant. We use the word deceive advisedly and with the intention of its being applied in its broadest sense, for the reason that last year's report was carefully analyzed by *The Michigan Investor,* its false character explained and that explanation brought to the notice of the commissioners. So that the members of the commission can no longer plead ignorance of the elements of cost which are deliberately left out in making up their statement to the public.

As if anticipating criticism of the methods of the commission, the *Detroit Free Press,* in commenting upon the report declared that the managers of private electric plants will find fault with the methods employed in preparing the report, and then gravely adds: "For the lighting commissioners and the people it is enough that the amount of money spent on them be divided by the number of lights in use and the result set up as the cost per lamp."

"Very well, *The Investor* will apply the *Free Press'* method of analysis of the cost per lamp to the figures presented and then we shall see where we come out. The commissioners show the following:

Total expenditure, 1904-1905	$218,665.23
Interest on the investment of $824,021.24, at 3½ per cent, which the commission never charges against the cost of lighting	28,840.78
Depreciation at 3 per cent, on investment of $824,021.24, which Commissioner Hinchman says is too low a depreciation percentage	24,720.63
Total	$272,226.64

"Now for this much money the commission kept an average of 2,818 arc lamps going last year, and enough incandescent lamps to have cost $22,755.17. Deducting the credit for incandescent lighting from the total cost we have a net cost for the arc lighting of $249,471.47, for 2,818 lamps, or $88.53 per lamp, for the year ending June 30, 1905.

"The *Investor* well knows that the rejoinder of the commission, if it makes any, will be that not all of its expenditures were for the cost of operation. It extended its plant $91,523.48 worth, according to its own statements and claims to have that much added capital investment. But we do not give it credit for having added that much to the value of the plant. We believe that an expert examination, of the kind which the lighting commission dared not permit during the present year by competent and unprejudiced persons would show that the money which it says was spent for permanent improvements was really expended to take up the results of depreciation, and as such is properly chargeable to operation. The fact remains that the city of Detroit last year spent in actual money paid by the lighting commission, in interest paid in part through the controller's office, and in part not charged, and in the depreciation of the plant at a ridiculously low rate the sum of $249,471.47, and for that has had 2,818 lamps kept in service, or at the rate of $88.53 per lamp. The commissioners ought to be able to hire the same service done by private parties at not more than $65 per lamp.

"The dishonesty of such reports as those of the Public Lighting Commission has bad effects outside the community in which they are published. They are used as the "come-alongs" of unscrupulous politicians and "fly" salesmen to get other communities into the same business on false pretences. As a basis for municipal investment they are absolutely unreliable, but just in proportion to their lack of reliability are they used as authority with other cities for the purpose of building up new machines and providing new contracts with employment."

Assessments of Indiana Telephone Companies.

The Indiana State Tax Commissioners have reported in favor of a decrease in assessments on the property of some of the telephone companies operating in the state, the most notable reduction being in favor of the Central Union Telephone Company from $54 to $40 a mile, making a total decrease in valuation of about $813,000. Another liberal decrease was made in the case of the Indianapolis Telephone Company, the assessed valuation being dropped from $160 to $100 per mile. The assessment of the New Long Distance Telephone Company, on the other hand, was increased from $30 to $40 a mile. The American Telephone Company, carrying the long-distance business for the Central Union, remains the same, $40 a mile. The assessment of the Cumberland Telephone Company doing business in the southern part of the state was reduced from $60 to $50 a mile. The independent companies did not fare as well as did the Bell companies. The assessment of the United Telephone Company, of Bluffton, was increased from $70 to $110 a mile; Delaware & Madison County Telephone Company, of Muncie and Anderson, from $105 to $135; South Bend Telephone Company from $90 to $100, and the Logansport Home Telephone Company from $30 to $35. The assessments for all the other companies remain practically the same as those of last year.

The assessment on the Fort Wayne Postal Telegraph Company and the Postal Telegraph & Cable Company were left as last year, $50 and $25 a mile, respectively, while the Western Union's assessment was raised from $40 to $44 a mile, making a total increase of about $184,000 in this year's assessment.

The Vulnerability of Trusts.

A paper was read last week at Niagara Falls, before the Commercial Law League of America, by Mr. Henry Wollman, of New York, on "The Mortality of Trusts." In the course of this interesting paper he remarked:

The men at the head of great combinations are men who by fierce fighting captured the situation. As a rule they are comparatively new men, who through superiority obtained their positions of leadership. In many instances they drove others out of the business or forced them into their combinations. What the men now at the head of the great trusts and combinations of this country have done to bring about their own leadership others may do to them. If they have the ability to successfully meet the attack, their institution will live; if they have not, it will go down. A trust that is started with the idea that having absorbed all competition no new competition can arise, is on very dangerous ground. The purchase of opposition as fast as it arises is a perilous price to pay for peace. The best basis for a trust is to know that by the combination it has introduced such economies and obtained such manufacturing genius and such facilities for marketing its products that it can successfully protect itself against all comers.

The strength of many combinations to-day is due to the fact that they are bulwarked behind important patents. As long as men have restless brains we will always have new and almost revolutionary inventions. If the combinations obtain and utilize them, they will contribute to their longevity; if they fail to get them and they are of sufficient importance to reduce the price of the manufactured

product below what the combination can afford to make it at, that will be the end of the combination.

In every line substitutes for the commodities made by the trusts, or for the basic material out of which those commodities are manufactured, will, to a greater or less extent, from time to time, be found. If these reduce the cost of production and the combination quickly avails itself of them, its success will be continued. If its managers have not the foresight, the elasticity or ability to bring these substitutes into the combination, and if they are of sufficient importance, and get into the hands of others, they may end or destroy the life of the corporation.

No one can foresee what changes may take place in the personnel of the management of a trust. You can take the best managed company, with a record of, say, fifteen years of unbroken success, and turn it over to three incompetent, overbearing, short-sighted or visionary men, and they will wreck it in five years. Let the management of any trust pass into the hands of arrogant weaklings, and its end will be near. . . . Trusts will live, not because they have great capital, not because they have blotted out competition, but because they are conscientiously, economically and ably managed. Those that do not pursue the correct principles of business will go down. Those that are fortunate enough to do so will last. Those trusts that serve the public the best will survive; the others will perish off the face of the earth.

Lodge and Muirhead Wireless Telegraph Patent.

A patent was issued August 1 to Sir Oliver Lodge and Dr. Alexander Muirhead on an application filed March 21, 1902, having the title "Syntonic Space Telegraphy." It is stated that in the invention three discoveries made by Sir Oliver Lodge are utilized, and reference is made to papers published in the *Proceedings* of the Royal Society in *Nature* relating to these. One publication describes a "recoil kick" experiment wherein a long wire attached to a discharging Leyden jar circuit was thrown into violent oscillation in synchronism with the jar; another experiment, called that of "overflow," wherein a long wire appendage was used to set up oscillations in the Leyden jar circuit and to cause it to overflow, and an experiment wherein the oscillations of one discharging Leyden jar or condensing circuit set up similar feeble oscillations in a distant Leyden jar or condenser circuit precisely attuned to the first. For the long-wire appendage referred to in the second experiment an antenna is used for the sender and the overflow is detected in the receiver by means of a coherer.

In carrying out the invention the coherer employed as a detector is connected to the receiving Leyden jar or condenser so as to feel and detect the overflow and at the same time be protected from the direct action of the aerial conductor or of any pulse or sudden jerk collected by it about which there is no tune. In the accompanying diagrams Fig. 1 represents the transmitting station, Fig. 2 the receiving station and Fig. 3 a modified form of receiving circuit.

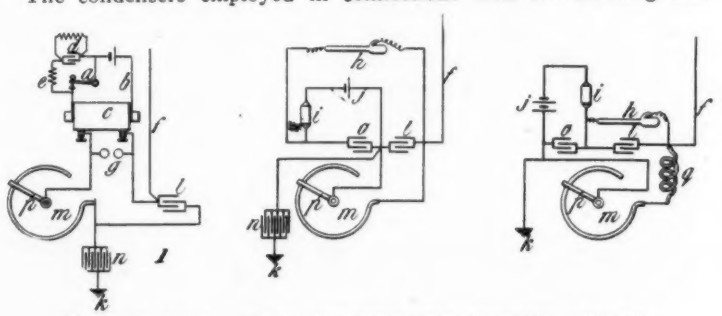
In the transmitting station there is employed in the emitting circuit a condenser, *l*, the opposite terminals of which are connected through a suitable self-induction, *m*, which may be a simple wire or may be a coil, with a spark gap, *g*, which is excited in the ordinary way by the induction coil, *c*, and trembling break, giving one spark for dot and two or more sparks for dash when the primary circuit, *b*, of the said coil is closed by means of a key, *a*, and which may be operated manually or automatically. One terminal of the condenser, *l*, has the aerial conductor *f* of appropriate length and capacity area reaching up to a considerable height connected to it, and the other terminal of the said condenser is connected either to earth direct or through another condenser, *n*, to earth as shown in Fig. 1. In the receiving circuit there is a similar condenser, *l*, closed through a similar self-inductance, *m*, but without any spark gap, so that oscillations of great feebleness can begin in it and work up to something perceptible. The condenser, *l*, when used for receiving, like the other when used for emitting, has an aerial conductor or capacity area, *f*, connected to it and reaching up to a considerable height to catch the pulses from the distant station and by means of them to excite and promote oscillations in the circuit of the condenser, *l*, to which it is attached, the other coat of the condenser, *l*, being earthed as usual. The receiving condenser, *l*, is provided also with an overflow path, in which the coherer, *h*, is inserted for the purpose of detecting the overflow with the battery, *j*, the telegraphic receiver, *i*, and a subsidiary condenser, *o*; for by this arrangement the telegraphic instrument, *i*, is able to indicate every cohesion caused by every overflow, provided the coherer, *h*, is kept constantly automatically tapped back by clockwork or other mechanism.

The object of the subsidiary condenser, *o*, is to act as a shunt to battery and receiver so far as sudden electric changes are concerned, and thus afford an easy path for overflow from the main condenser, *l*. It does not necessarily form part of the oscillating circuit, and the amount of its capacity is immaterial so long as it is large enough not to throttle or interfere with the oscillations or with the free overflow of the condenser, *l*, into the coherer, *h*, and so long as it is small enough to help protect the coherer from undesired disturbances collected by the aerial conductor, *f*.

In order to provide efficient tuning or synchronism between the sending and receiving circuits, the length or self-induction of each condenser circuit is capable of adjustment within certain limits by means of an arrangement such as sliding contacts or a revolving arm, *p*, or it may be done in any ordinary way as by approaching or receding the spirals of a coil or two portions of a coil, *q*, in Fig. 3.

Sometimes between the aerial conductor and earth there may be inserted, as shown in Fig. 3, the two condensers, *l* and *o* (of suitable capacity for their respective functions) in series, and also the adjustable self-induction *m*. Only one of these condensers is intended to overflow, and with this one the terminals of the coherer are connected directly, as shown in Fig. 3, instead of through the supplementary condenser, as in Figs. 1 and 2.

The condensers employed in connections with the emitting and



FIGS. 1, 2 AND 3.—LODGE AND MUIRHEAD SYNTONIC SYSTEM.

receiving circuits are sometimes made of stout glass plates coated with tin foil and the whole embedded in paraffin wax, or preferably of metal plates or cylinders submerged in oil or other insulating liquid.

The self-induction *m* in most cases consists merely of an almost complete circle of thick copper wire, as shown, the circuit being closed by means of the spring copper revolving arm, *p*, which rotates about the center of the circle merely varying its length for the purpose of the fine adjustment of tuning. For coarse adjustment this circular strip of copper is supplemented by an open spiral of thick copper wire, as shown at *q* in Fig. 3, or by any additional self-induction adjustable in any well-known way.

The action of the emitter upon a receiver is as follows: The induction coil, *c*, of the emitter charges the condenser, *l*, of the emitting station and discharges it at the spark gap, *g*, thus setting up oscillations in the circuit of the condenser, *l*, through the self-induction, *m*, the frequency of which can be adjusted by varying the amount of self-induction thereof. The elevated conductor, *f*, which is attached to the discharging condenser circuit through *l*, *m* and *g*, is at the same time thrown into violent electrical oscillation in synchronism with the condenser, *l*, and these oscillation impulses are reflected by the elevated conductor at its upper end in a series of recoil-kicks, each of which communicates to the other a considerable disturbance, resulting in electric waves which travel through space. On reaching the distant station, Fig. 2, these waves set up oscillations in its elevated conductor, *f*, which is attached to a condenser circuit similarly attuned to that of the emitting station, but without the spark-gap, wherein are set up similar oscillations, which work up gradually in strength until they become strong enough to break down the resistance of the coherer, which happens so soon as the maximum potential attained by these oscillations in the condenser circuit is high enough to cause an electrostatic overflow through the coherer, *h*, the result being a diminution in the resistance of the latter and the formation of a signal on the receiving instrument, *i*, as is well understood. The battery, *j*, and receiver, *i*, in the overflow circuit are shunted by a supplementary condenser, *o*, so as not to let them form an obstruction to the easy overflow into

the coherer. The novelty in this part of the invention is the mode in which the coherer, *h*, is connected to the receiving condenser, *l*, so as to feel and detect the overflow and at the same time to be protected from the direct action of the elevated conductor, *f*, or of any pulse or sudden jerk collected by it about which there is no tune. It is found that the concentration of the stimulus on needle-points instead of on surfaces of finite magnitude as in the construction of coherers hitherto is advantageous.

The specifications state that the patentees are aware that it has before been suggested to employ condensers in systems of syntonic Hertzian-wave telegraphy for other purposes, such as the adjustment of the effective amount of inductance in transformers or self-inductance coils, but the function of the principal condenser, *l*, as explained, is entirely different therefrom, it being employed in series with a self-induction of suitable amount to form a tuned, closed condenser circuit required in the system of syntonic telegraphy based on the principles of the "recoil kick" in the emitting circuit and the "overflow" in the receiving circuit.

The claims are for a condenser and a self-induction of suitable amount forming an attuned condenser circuit closed through such self-induction, an overflow path, a coherer in such overflow path, and a subsidiary condenser in shunt to the receiving instrument and its battery, or in series with the main condenser and also in the attuned circuit, and in shunt to the receiving instrument and its battery.

Boilers and Mechanical Stokers.

One of the valuable features of the "Question Box" of the N. E. L. A. resides in the fact that the answers come from men having knowledge acquired by actual experience. The differences in the opinions that are expressed serve to show that experiences differ according to the conditions of operation. The combination of the numerous opinions is thus of much greater value than the opinion of one man, however well qualified technically, but with necessarily limited experience.

In answer to the question, "Are mechanical stokers recommended for small plants of, say, from 100 to 500 hp? Of 2,500 hp?" one person says, "No; and it is an open question as to the actual benefit of stokers for large plants," while another replies, "Our opinion would be that mechanical stokers are economical for almost any size of plant." The other answers received agree that for plants smaller than 500 hp mechanical stokers should not be used, but that for plants as large as 2,500 hp stokers are to be recommended. The query "Is there an actual saving in using stokers, irrespective of cost or quality of coal?" elicited nine replies. Of these three express doubt as to any saving, while from the others it appears that there is a saving in labor. It is learned from six replies to a query as to the effect on the efficiency of a boiler that this is only slightly increased by the use of mechanical stokers, but that they permit the burning of a cheap grade of coal. Six replies relating to smoke consumers serve to show that what the device actually does is to produce more perfect combustion and thus to prevent the formation of smoke. While opinions seem to differ as to the advisability of blowing flues with steam, two negative and eight affirmative answers being received to a question concerning this process of cleaning tubes, the consensus of opinion is that if the tubes are blown while hot the steam is not injurious.

Twelve answers were received to the question, "Is it better to expand boiler tubes with boiler full or empty?" Eight of these recommend having the boilers empty, two state that if the boiler is of the proper type it can be full, and two intimate that either method can be used. Three engineers make three different suggestions as to an appropriate method for keeping the external surfaces of tubes free from soot in a water-tube boiler, other than the ordinary method of blowing with steam or air. These are as follows: "Feed the blower with dry sand while blowing," "Forced draft will tend to keep the boiler surfaces clean," and "Use the broom." A query as to the best method of keeping in good condition a boiler that is not in use, brought forth twenty replies. Fourteen recommend drying out the boiler thoroughly, using lime to absorb the last traces of moisture; two suggest keeping the boiler full of water, two intimate that either method is satisfactory, while two state that unless the feed water is exceedingly good, it is best to steam the boiler at least once a month. The ten answers to an inquiry as to the best method of procedure when it is discovered that the pressure of a 100-pound boiler has increased to 175 pounds are variously expressed, but none is contrary to the one which states, "Under the circumstances suggested in this question, the safety valve should never be touched. A safe method to let off the pressure would be to bank the fire heavily with green coal and to blow off very gently through the blow-off pipe."

Six answers were received to the question, "What are the results of storing heat or steam in a large boiler plant by banking all the fires but one and supplying steam from that one to maintain pressure in the idle ones?" Five of these state that the boilers with banked fires act as condensers, and that the method is not economical. The sixth answer intimates that fuel can be saved if the fires under the idle boilers are lightly banked in such a manner that each boiler makes some little steam, the one boiler being used to supply steam to the load. The composite reply to a query concerning the deterioration in axles and wheels of gravity-bucket continuous coal-and-ash conveyor systems is that the cause can be attributed to sulphuric acid, and that a cure can be found in removing the rust and covering the surfaces with graphite paint.

Losses in an Electric Transmission.

The calculation of losses in power transmission is always an important part of distribution work, and the results of actual tests on transmission lines are interesting. An example drawn from practice on a New England street railway operating through several adjoining towns may be cited as pertinent.

The apparatus tested consisted of a 300-kw alternator direct connected to a 450-hp engine. The alternator supplied three-phase current at 380 volts to three 90-kw transformers, which raised the potential to 13,000 volts for a 13-mile, three-phase transmission over three No. 2 aluminum wires to the substation, where the voltage was cut down to 380 by three 90-kw transformers and converted in a rotary to 600 volts direct current. The frequency of the system was 25 cycles.

With 530 i.h.p. (395 kilowatts) at the engine the direct-current output at the substation was 268 kilowatts, corresponding to about 32.1 per cent loss, or 67.9 per cent efficiency. The losses between the engine cylinders and the high potential bus bars in the generating station came to 12.9 per cent; the line loss was 5.5 per cent, and the substation losses 13.7 per cent. The striking point in the figures is the loss incurred in the transformers and rotary converter in comparison with the transmission line. It would seem to have been better practice to have omitted the step-up transformers in the power station and to have purchased an alternator wound directly for the line potential. The belief is increasingly held that the elimination of step-up transformers is desirable for moderate transmissions. The danger of a shutdown on account of lightning is generally considered not serious enough to preclude placing the generator directly across the line, and the gain in operating efficiency is well worth while in a steam plant.

Value of Natural Gas Production.

The approximate value of the natural gas produced and sold in the United States, as reported to the United States Geological Survey, is shown in the following table:

State.	Value.
Arkansas and Wyoming	$6,515
California	114,195
Colorado	14,300
Illinois	4,745
Indiana	4,342,409
Indian Territory and Oklahoma	49,665
Kansas	1,517,643
Kentucky	322,404
Missouri	6,285
New York	522,575
Ohio	5,315,564
Pennsylvania	18,139,914
South Dakota	12,215
Alabama and Texas	14,082
Utah	
West Virginia	8,114,249
Total	$38,496,760

The Kentucky item includes a small quantity produced in Tennessee. The total does not include the value of natural gas produced in Canada and consumed in the United States. This appears not to pay duty and is not brought to account in any definite manner.

The Indiana Telephone Situation.

President George W. Beers, of the Indiana Independent Telephone Association, has publicly declared that all the independent telephone companies would discontinue toll-line service with the United lines within a week. The United Telephone Company, over the Ohio line, has already been disconnected. The United Telephone Company, Mr. Beers states, has violated its contract in throwing its toll business to the Bell Company, while incoming business over the independent lines shows an increase.

Similar complaints of discrimination come from Frankfort, where the Bell has recently gained a foothold, and it is not believed that present arrangements to divide the toll line business will last very long.

CURRENT NEWS AND NOTES.

TELEGRAPHERS' STRIKE.—The telegraphers on the Northern Pacific lines of railroad went on strike last week, but the system has remained in operation without any serious inconvenience to the public, and it is said by the management that freight is also being handled successfully.

FRANKLIN IN PARIS.—The city of Paris is to have a statue of Benjamin Franklin. Mr. John Marjes, the donor of the fine statue in Philadelphia, has offered a duplicate of this to Paris, and it has been accepted. It will be placed at the corner of the Rue Franklin, opposite the Trocadero Museum.

LIGHTNING DAMAGE.—On the night of Aug. 6 lightning damaged the plant of the Trenton Falls Power Company, Trenton Falls, N. Y. It is stated that the switchboard was damaged and the interior of the station wrecked. The damage is estimated at $15,000. The high-tension wires on the line were snapped by the lightning.

WIRELESS IN SCOTLAND.—A cable dispatch from Edinburgh, of August 5 says: "The latest form of American enterprise in Scotland is the erecting of a wireless telegraphic station at Machrihanish, in the Western Highlands. A tower 400 ft. high is being raised on six acres of land leased by the National Electric Signaling Company, of Pittsburg. The Brown Hoisting Company, of New York, has the contract. Communication is to be made with Boston and a revolution in the cost of sending messages across the Atlantic is looked for. In three months' time the instruments should be at work."

THE POPE'S TELEPHONE.—A cable dispatch from Rome of August 5 says: "The Pope has adopted the telephone habit. The Vatican is now as elaborately wired as any great financial institution or hotel in the United States—house, local and long-distance telephone in every room. The long-distance telephone most often used by the Pope is the wire connection with Venice, his old place of residence and useful activity. From Venice come stories of all sorts of people who are occasionally called up by Pius for a moment's chat or some personal instruction. The Pope himself selected the telephone apparatus used in the Vatican."

A. S. R. A. MEETING.—The annual convention of the American Street Railway Association is to be held in Philadelphia in the South Building of the Philadelphia Museum, on September 25-30. The Mechanical and Electrical Association and the Claim Agents' Association will meet on September 25 and 26. The Accountants' Association will meet on September 28-30. The report of the reorganization committee and a new constitution will be presented. Papers are to be presented on gas engines, single-phase railways, etc. There will be a very large exhibit of street car material. Headquarters will be at the Bellevue-Stratford.

STARTING OF POLYPHASE INDUCTION MOTORS.—In order to be able to decrease to a minimum the secondary resistance of a polyphase induction motor whose starting characteristics are obtained by inserting resistance in the secondary circuit, Mr. Leo Schüler, according to a patent issued August 1, would employ an auxiliary short-circuiting device connected in parallel to the usual three-point variable resistance. The construction of the secondary member differs from the standard coil-wound type in being provided with a shunting device similar to that employed with the familiar self-starting single-phase repulsion-induction motor.

STATE LIGHTING COMMISSION.—The new State Lighting Commission of New York has organized this week and finds itself busy. It has to meet once a month at Albany, but will have an office in New York City. The members are F. E. Gunnison, chairman; John C. Davies and L. L. Shedden. Under the law which created the commission all lighting and power companies desiring incorporation or changes in their charters or wishing to increase capital stock or issue new bonds, must make application to the commission and secure its approval before complying with the terms of the stock incorporation law. Just before the law went into effect there was a rush made by a large number of companies from all over the State to incorporate under the old laws. Since then several companies have filed applications with the commission for permission to increase their capital stock and issue bonds.

VARIABLE-SPEED INDUCTION MOTOR.—A patent issued August 1 to P. Jigouzo has for its object to produce an induction motor suitable for operating roller bridges, lifts, winches, etc. The motor comprises three concentric parts, one of which moves between the other two, which are fixed parts. The movable part carries a squirrel-cage secondary winding. There are two primary windings on one fixed part and one primary winding on the other fixed part. Each primary winding is arranged for a certain number of poles different from that of each of the other windings. One winding, having a medium number of poles, is used for starting purposes. A second winding, having a small number of poles, is used for ordinary operation, while the third winding, having a large number of poles, is intended to assist in bringing the rotor quickly to rest when desired.

MOTOR METER.—A patent issued August 1 to C. P. Steinmetz relates to the application of the retarding-coil principle in the construction of a motor meter. The primary member of the motor is wound with two sets of coils, in one of which the current is proportional to the e.m.f. of the supply mains and the other of which is connected in series with the load circuit and carries the load current. The fluxes due to these two currents are displaced in time-phase on account of the difference in the time constants of the two circuits. A third flux, dephased from each of the others, is obtained by the use of a retarding coil on a portion of the core material which is subjected to the m.m.f. of the shunt current. This third flux lends a starting torque sufficient to balance friction at no load, thereby doing the work of a special starting coil, and it also serves to slow down the meter when the lag increases in the circuit so as to maintain the registration proportional to the true energy consumed in the circuit.

THE GOVERNMENT AND TELEGRAPHS.—Attorney-General Moody has requested the United States District Attorneys at Madison, Wis.; Milwaukee, St. Paul, Fargo, N. D.; Helena, Mont.; Boise, Idaho; Spokane, Wash.; Seattle and Portland, Ore., to investigate the facts as to the interruption of telegraphic service on the Great Northern and Northern Pacific Railroads, in view of the government's duty to keep unobstructed the avenues of interstate commerce. The Western Union Telegraph Company, in connection with the inquiry, announced that that company and its employes are in no way involved in the strike of the railroad telegraphers. The following is the telegram of the Attorney-General to the district atorneys: "I am informed that for several days the transmission of interstate, foreign and government messages over the Western Union lines which follow the Great Northern and Northern Pacific Railroads has been seriously interrupted. In such a situation, if it exists, the government, whose duty it is, by all means at its command, to keep open and unobstructed the avenues of interstate commerce and to protect its own communications, has grave concern. You will immediately investigate with all possible speed the facts, and if you find the interruption exists endeavor to ascertain the reason, reporting to me fully by wire."

WIRELESS ON OIL SHIP.—The Standard Oil Company's sailing ship *Astral,* plying out of San Francisco, has been equipped with a wireless telegraph plant, enabling her to communicate with the various wireless stations on the Coast.

THE KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION will hold its next annual meeting in Kansas City., Kansas, October 14 and 15 next. Mr. James D. Nicholson, of Newton, Kan., is the secretary of the association.

AMERICAN ELECTROCHEMICAL SOCIETY.—The next meeting of the American Electrochemical Society will be held at Bethlehem, Pa., Sept. 18, 19 and 20 next. The association on this occasion will be the guest of Lehigh University. Mr. S. S. Sadtler, Philadelphia, Pa., is secretary of the association.

JAPANESE PURCHASES.—Japan has just bought in this market for immediate delivery 150 locomotives, from the Baldwin Works, to cost $2,225,000; 350 steel bridges from the U. S. Steel Corporation, to cost $500,000, and 2,000 steel cars, to cost $2,000,000. Apparently this mass of material is for work in Korea and Manchuria.

ST. PETERSBURG TROLLEYS.—A cable dispatch of August 3 from St. Petersburg refers as follows to what has now become a very old story: "The newspapers state that a $15,000,000 contract for the equipment of 14 St. Petersburg street car lines with electricity will be awarded shortly. German, French, and Belgian firms, and one American concern, the Westinghouse Company, are competing for the concession."

CONEY ISLAND DEVELOPMENT.—A further step is being taken in the creation of great amusement centers at Coney Island. The Brighton Beach Development Company is now to spend $2,000,000 on a new resort, including a mile-long pike. The Brooklyn Rapid Transit system will build a new station and special lines connecting Coney Island with Brighton. The Brighton Beach Park will be a permanent amusement exposition. Venetian canals will extend through the grounds and an electric observation tower will form part of a great gateway at one end of the Pike.

A TALL TELEPHONE POLE.—What is thought to be the tallest telephone pole, if not the tallest pole of any kind, in the world, is located on the south side of the Chehalis River, about a mile east of Aberdeen, Oregon. It is 116 feet high and was cut from a tree nearly 200 feet tall. The object in having the pole so high is that the wire span will not be caught by passing ships as it crosses the harbor to the north side and rises above a hill covered with pretty good sized trees on the east banks of the Chehalis. The pole was made from a fir tree. It belongs to the Sunset Telephone Company.

WIRELESS IN ALASKA.—A special dispatch from Tacoma, Wash., of July 24 says: "The Federal Government is preparing to install the wireless telegraph system throughout the Lower Yukon country, replacing land lines that have proved failures to a large extent. The greatest difficulties have been encountered in maintaining the land system in the face of forest fires, floods, cold weather and other obstacles. Capt. Wildman, the Government wireless expert, is now on the Yukon experimenting with the wireless between Fort Gibbon at the mouth of the Tanana River and Nome. He was in constant communication with St. Michael's on the trip up the river to Fort Gibbon. St. Michael's in turn was connected with Nome."

CHICAGO CITY TROLLEY SCHEME.—It is stated from Chicago that Mayor Dunne, in his revised propaganda for "ultimate" and not immediate municipal ownership, is following the advice given in the letter of James Dalrymple, the Glasgow expert, which the Mayor suppressed. Mr. Dalrymple finds a special obstacle in the valuations of existing lines, based on what the present owners paid for them. Therefore, he recommends that the city, while announcing its intention to take over the lines in the future, allow the traction companies "to continue to operate in the streets for a sufficient time to work out their present franchise values." This is the plan of the tentative ordinance. The nature of Mr. Dalrymple's advice is the reason why the administration, which invited him to Chicago, has kept it secret. Mr. Dalrymple warns Mayor Dunne that it would be out of the question for the city to make a success of municipal operation under present political conditions.

THE CHICAGO FREIGHT SUBWAY.—President A. G. Wheeler, of the Chicago Subway Company, in discussing the future of the company, says: "At present we are handling 7,000 tons of freight daily, and we still expect that this amount will be increased to 30,000 tons daily by January 1. It is a great task to connect our tunnels with all the railroad freight terminals. We are connected with a few, but cannot say just when all will be able to ship their freight through the subway. We are independent of outside criticism to the extent that we believe we have a gigantic proposition that will fulfill every expectation. I may say that we expect to pursue a conservative policy as to dividends. Earnings will be put back into improvements as needed and the equipment maintained at a high standard so that there will be a splendid basis for profits for shareholders." The city has demanded the books of the Chicago Subway Company and will enforce the collection of 5 per cent of gross receipts in accordance with the terms of the franchise. Two thousand men are at work in the tunnels completing connections with railroads.

COURSES IN TRANSPORTATION.—Continuing its good work of last year, the Polytechnic Institute of Brooklyn announces a series of evening courses for the year 1905-1906, in transportation, steam engineering, water supply, structural design, draughting, mathematics, chemistry and electricity, with laboratory practice and testing. These lectures are designed to be concisely practical in their treatment of the subjects. Problems illustrating the subject will be announced by the lecturers and encouragement given to those desiring to solve them to present reports in professional form. Those wishing to enter as candidates for a degree will receive credit, upon the requirements for the degree, for the reports so filed, upon previous arrangement to that end with the president and the professor in charge. The fee for the course on transportation is $15. The fees for the other courses are at the rate of 40 cents an hour for 100 hours or under, 35 cents an hour for 100 to 200 hours, and 30 cents an hour for 200 or more hours. A number of prominent men will lecture from October 10 to April 24, including Messrs. Stott, Lardner, Calderwood, Mershon and Barstow, and Mr. Mailloux will give a special course of fifteen lectures on train movement.

AN ELECTRIC CITY.—A correspondent of the New York *Sun* furnishes this excellent pen picture: "Schenectady is a busy city these days. Long lines of freight cars loaded with electric machinery and locomotives for all parts of the world pull out of the yards every day. Between 6 and 7 o'clock each morning the streets are full of men and women hastening to their places of work. Then between 7.30 and 8 o'clock follow the office contingents. More than a thousand work in a single building. Street cars pass rapidly—almost one a minute—loaded to the steps and on the steps with cheerful workers, sure of continuous work at good wages and a regular weekly payday. In June the Schenectady Railway Company broke all records in the number of passengers carried, namely, 1,001,685, an increase of 42,830 over the same month last year. This volume of street railway traffic for a city of about 60,000 people is remarkable, even allowing for the people carried to and from their work in Schenectady who live in Albany, Troy, Ballston, Amsterdam, Gloversville or other of Schenectady's many suburbs. At 5.30, when the big factories close, the streets and cars are fairly black with the crowd of nearly 20,000 tired but happy workers hastening to "home, sweet home." Then an hour's quiet for supper, and again the streets are crowded with thousands bent on a few hours of enjoyment. "Early to bed and early to rise" is a well-practiced motto in Schenectady. By 10 o'clock the streets are again almost as quiet as they were for the twenty-four hours of each day in the years before industrial activity struck the town. Still, even at night and all night (except Sundays) the factories are still alive with a thousand or more workers doing extra work and getting things in shape for the thousands of day workers."

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION.—At the executive session of the Pacific Coast Electric Transmission Association, held at Portland, Ore., June 30, Mr. George P. Low was elected president and treasurer; Mr. H. H. Sinclair, of the Edison Electric Company, Los Angeles, Cal., was elected vice-president, and Mr. Samuel G. Reed, of the Portland General Electric Companl, was elected secretary.

TROLLEY LOTTERY TICKETS.—In a recent issue of the *Mexican Herald* a description was given of the scheme by which the tramway company operating in the city of Mexico popularizes its cars by having the fares punched on tickets, which are afterwards good for drawings in a lottery. There is also a plan under way by which the tickets may be accepted in part purchase of commodities bought at certain stores, which enter into an agreement to accept them to the extent of say 5 or 10 per cent on all purchases.

FUNERAL BAKED MEATS.—The Japanese and Russian peace envoys, who are seeking to bury the sword, are in conference this week at the Navy Yard, Portsmouth, N. H. The commissariat department is on a luxurious scale, but the meals for the envoys are to be cooked outside the building, and then kept heated or rewarmed by an electric kitchen supplied with current from the navy yard plant. Thus everything can be served piping hot at a moment's notice, no matter how great the wait or delay.

ACCIDENT GRAFTERS.—Street railway companies have been great sufferers from accident "fakers" and "grafters," and organized steps are now being taken against the evil. An association has been formed including in its membership the big accident insurance companies, the largest street railway corporations of the East and Middle West and many of the steam railroads, for the purpose of furnishing information as to the schemes and identity of professional accident grafters and to follow up their prosecution regardless of expense.

MORE ATLANTIC CABLE.—The cable steamship *Colonia* sailed from England on August 5 with 2,400 miles of Atlantic cable on board, to be laid for the Commercial Cable Company, between Ireland and Nova Scotia, and Nova Scotia and Newfoundland. The New York *Tribune* remarks: "Marconi's splendid work, which has been before the world at least three years, seems to have had little influence upon the submarine cable companies. New wires are being manufactured and laid under the ocean every year. Probably half a dozen enterprises of this kind have been carried into execution within the last thirty-six months. One of them is for communication between San Francisco, Hawaii and the Philippines. Next week the operation of stretching still another cable across the Atlantic from Ireland to Newfoundland will begin."

U. S. MAGNETIC SURVEY.—A magnetic survey of the North Pacific Ocean will be begun within the next few days by the Department of International Research in Terrestrial Magnetism of the Carnegie Institution at Washington. A wooden sailing vessel, the brig Galilee, has been fitted for the purposes of the expedition at this port, and it is expected that she will sail the latter part of the week on her first season's work. The director of the work is Dr. L. A. Bauer, who likewise is in charge of the magnetic work of the United States Coast and Geodetic Survey. The scientific leader and commander of the Galilee will be J. F. Pratt, of the United States Coast and Geodetic Survey. The members of the scientific corps are Dr. J. Hobart Egbert, magnetic observer, surgeon, and naturalist; J. P. Ault, magnetic observer, and V. W. Whitney, magnetic observer and watch officer.

FRENCH CABLE IN VENEZUELA.—The Federal Court of Cassation of Venezuela on August 4 gave final judgment in the matter of the proceedings instituted against the Compagnie Francaise des Cables Telegraphiques, confirming the dissolution of the contract of the government with the company. Last March 31 President Arnal, of the highest Venezuelan court, decided that the French Cable Company had forfeited its contract by failure to fulfill its terms. The decision rendered now is by the entire court. The differences between President Castro and the French Cable Company have existed for some years. As set forth by Francisco Arroya Parejo, Attorney General of Venezuela, the grounds on which the original decision was rendered were as follows: The company contracted to construct a submarine cable between La Guayra and the United States, but it built a land line over Santo Domingo, and repeated Domingan revolutions interrupted it, causing loss to Venezuelan commerce. The company also contracted to construct national coastwise cables, but made the line international from Puerto Cabello to Coro by touching the Dutch Island of Curacao.

Electrical Engineers of the Times.—XXII.

S. M. KINTNER.

Samuel Montgomery Kintner was born in New Albany, Ind., December 11, 1871. His early education was received in the public schools of New Albany and he entered Purdue University in the fall of 1890. This was the period at which most of the young "Gentlemen from Indiana" who have added to such to the reputation of that State were passing through college. The classes of Purdue during this period were especially strong, and many members have achieved professional eminence. While at Purdue Prof. Kintner took an active interest in athletics, playing on both football and baseball teams. He was graduated in 1894 with the degree of Electrical Engineer and later took special work in mathematics and physics at Cornell.

Prof. Kintner's first electrical work was done in constructing and operating telephone systems for the independent companies at Shelbyville and Frankfort, Ind. In September, 1895, he was appointed to the position of assistant professor of electrical engineering of the Western University of Pennsylvania, now the University of Pittsburg. In 1897 the assistant professorship of mathematics became vacant and he was appointed to fill the position and later in 1900 succeeded Prof. Fessenden in the chair of electrical engineering.

S. M. KINTNER.

During these years Prof. Kintner made a great many scientific investigations in connection with the magnetism of iron, high-vacuum phenomena, and electrical oscillations, a great deal of this work being of a highly original and valuable character. Some of the results of these investigations were presented before the Engineers' Society of Western Pennsylvania and the Pittsburg Academy of Science and Arts. In addition to the purely scientific work a considerable amount of technical work was undertaken for clients during these years.

In 1903 he resigned from the Western University of Pennsylvania in order to accept a position with the Westinghouse Electrical & Manufacturing Company, where his great familiarity with and his extensive theoretical knowledge of electrical oscillations and high-potential phenomena have resulted in many valuable improvements in connection with the transmission of electrical energy at high potentials. A great many investigations have been carried out by Prof. Kintner on line disturbances, insulation details, static phenomena, etc., which have been most fruitful in results and for many of which patents are now pending.

From time to time Prof. Kintner has written scientific papers on various subjects and recently at the Asheville meeting of the American Institute of Electrical Engineers he presented a paper upon a novel and interesting type of static voltmeter which appears to have solved one of the most difficult problems in connection with high-voltage measurements.

Hydro-Electric Development at Turners Falls.

THE Connecticut River flows 375 miles and drops 2,038 feet from Third Lake, in northern New Hampshire, to Long Island Sound. Along the greater part of its length the river forms the boundary between Vermont and New Hampshire, and then it flows across Massachusetts and Connecticut. The drainage area of the Connecticut above its mouth is 11,085 square miles, and the upper part of this area is forest-clad to a large extent. Down between the Green Mountain and the Granite State, the course of the river lies mostly in a narrow bed of hard rock with high hills on either side that rise abruptly, in some cases to as much as 1,000 feet above the water surface. These conditions of the river valley continue down into central Massachusetts, and are found at Turners Falls, where the water power development, which forms the subject of this sketch, is located.

It is hardly necessary to say that a river bed of nearly continuous ledge, and high rocky banks on either side, has ideal conditions for

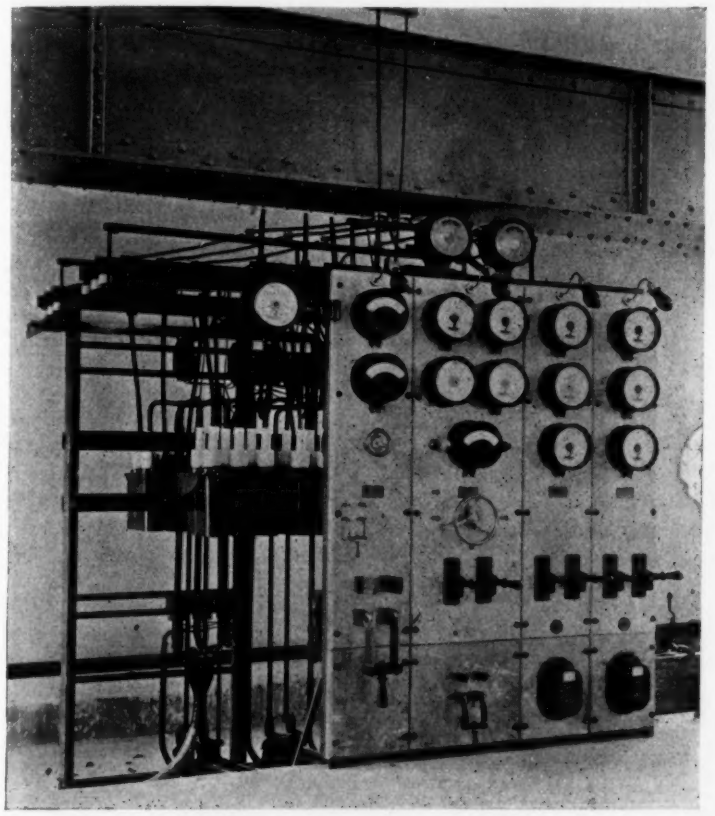


FIG. 1.—SWITCHBOARD.

the development of water power, when they occur in connection with a natural fall and a series of rapids. These are the natural conditions at Turners Falls that have been developed by a masonry dam, a canal about a mile long, and a station with turbine wheels and generators for the development of electric power. Water power development is not a new thing in Turners Falls. For some years a dam there has diverted the water of the Connecticut into a short canal parallel with the river, and between this canal and the bank of the main stream, a paper mill, a cutlery works, a textile plant, and other manufactures have been established. Power for these plants is obtained by drawing water from the canal and discharging it through turbine wheels into the river, at heads that vary with the locations of the wheels downstream from the dam. Like many other points where large water powers have been developed, but not supplemented by electric distribution or transmission, Turners Falls has not attracted enough manufacturing enterprises to use more than a fraction of the water that comes down stream, and on a recent visit there by the writer most of the river seemed to be going over the dam.

But this waste of energy that comes rushing down from the Granite Hills and Green Mountains is to be stopped. The old canal has been widened and lengthened, thus making available a greater head and volume of water at its down stream end. Instead of the old wooden gates there are now eight of steel covered by a substantial brick gate house at the head of the canal. At the lower end of the canal, between it and the river, stands the new electric power house with its concrete foundation sunk below the river level and pierced by the arched tail races of the turbines. In this power house space is provided for six sets of turbine wheels and six alternators with a combined capacity of 4,600 kw.

Industrial developments are based on law. Penetrate Darkest Africa, find a race so savage that the will of the majority is never

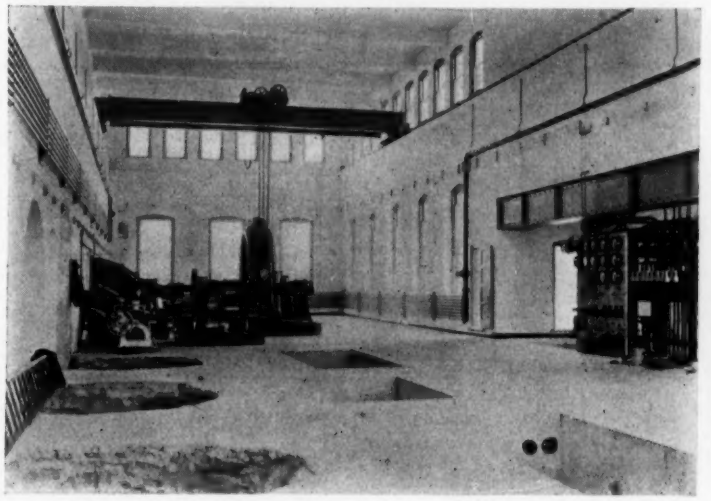


FIG. 2.—VIEW OF INTERIOR OF STATION.

impressed on the individual, where every man is a law unto himself, and each member of that race, like the monkeys around him, will control only so much of material things as he can carry about. So, too, in a land where personal rights in property are created and protected by law, the forms which property takes and the uses to which it is put depend on the same system of law by which the rights are created. This electric development of water power at Turners Falls is a case in point. In that small village the probable extension of power consumption at profitable prices is very moderate. During nearly a score of years the rulings of the Gas and

FIG. 3.—VIEW OF EXTERIOR OF STATION.

Electric Light Commissioners have excluded competition from the electric field in Massachusetts. Without the legal right to supply consumers over a large territory, the electric water power development at Turners Falls was not, and probably would not have been made. In 1903, a great water power company with a location some miles down stream from Turners Falls, went before the Legislature and got authority to invade some of the best electric markets of the State. Following this lead the company owning the water power at Turners Falls called at the state house, in 1904, and took away a charter to transmit and sell electric energy throughout Franklin and Hampshire counties, certain towns excepted. A result has been the erection of the new hydro-electric plant above mentioned. No opinion is expressed here as to the wisdom of this legislation, but the development at Turners Falls is simply pointed out

as one of the things to which it has led. One of the places in which the energy developed at Turners Falls may be sold is Northampton, a city of 18,643 persons, in 1900, which is served by a prosperous electric light company. This company has come down from the days, some nineteen years ago, when the Thomson-Houston and the now forgotten Schuyler arc systems, one operated by a planing mill engine, and the other by the steam plant in an abandoned machine shop, were hot competitors for public favor and municipal franchises. Here, too, is Smith College, where young ladies learn things. As the train stopped at the Northampton depot the other day, just as the dear girl graduates were departing, it was a little pathetic to note the difference in their baggage. Some pieces were large and substantial, with polished leather and brass mountings. Other pieces, including even the discarded grocery box with rope handles, were very small and poor, telling of the struggle for a college education.

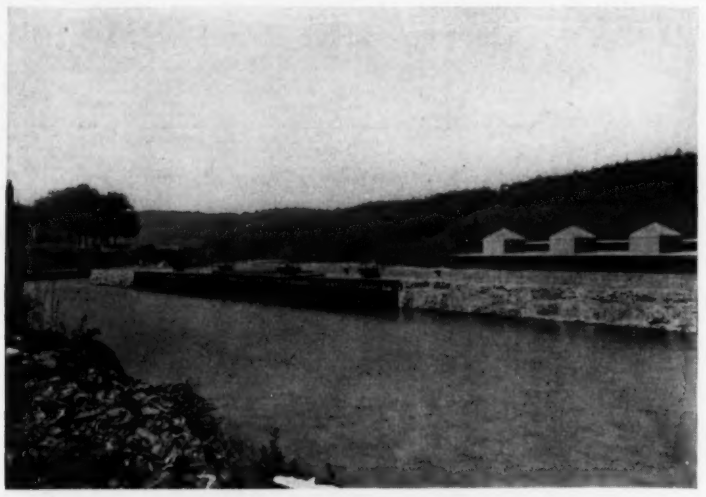


FIG. 4.—VIEW OF CANAL.

FIG. 5.—DAM AT TURNERS FALLS.

Besides the right to distribute electric energy for any purpose in all parts of Franklin and Hampshire counties, save in the towns of Orange, Greenfield, Amherst, Buckland, Sherburne, Deerfield and Bernardston, the company at Turners Falls may sell current to any street railway with tracks in Franklin County.

The new electric plant at Turners Fall is a substantial one-story brick building on a foundation of concrete arches, and sits with its longer sides parallel with the canal and the river. On the canal side of the station is the room for the horizontal turbine wheels, and on the river side of the station and separated from the turbines by a thick masonry wall is the room containing the electric generators and switchboard. Space and penstocks have been provided for eight pairs of turbine wheels and eight generators. Two of these generators will be used as exciters, and the other six will develop alternating current. Of these six alternators two will have a capacity of 300 kw each, and four will be rated at 1,000 kw each, giving an alternator capacity of 4,600 kw. A single pair of horizontal turbines is direct-connected to each 1,000 kw generator, and is designed to operate at 200 r.p.m. with the head of 39 ft. maintained by the canal. One exciter and one 1,000-kw alternator are now in position. These machines are of the Bullock make, and the alternator is rated at 2,300 volts, 60 cycles, three-phase. In strong contrast with this equipment is the first dynamo erected in Turners Falls, a 50-lamp incandescent machine that went into service 19 years ago.

As far as can be learned, the present equipment is not to include any step-up transformers, but with the voltage just named it is obvious that no extended transmission can be carried out. The power development at Turners Falls has, however, at command the entire discharge of the Connecticut River, at the head of 39 feet, named above. Of this discharge an apparently small, but unknown, quantity is used by the local manufacturers, and the remainder will be available at the electric plant. At Holyoke, 36 miles down stream from Turners Falls, the discharge of the Connecticut River is materially greater than it is at the latter place, as the Deerfield River and a number of smaller streams join the Connecticut between these two points. During 1896, the minimum amount of water drawn from behind the Holyoke dam in any one day was in August, when it fell to 450 cubic feet per second. For that entire month the average discharge of the river was 2,965 cubic feet per second, or 182,311 acre feet in all. In 1897 the minimum discharge at Holyoke was 1,300 cubic ft. per second, on an October day, and the average discharge in that month was 3,668 cubic feet per second, amounting to 225,536 acre feet during the month. In April, 1896, the average discharge of the river at Holyoke was up to 42,363 cubic feet per second, and, in April, 1897, it was 35,478 cubic feet. The minimum monthly discharge of 3,668 cubic feet per second at Holyoke, in 1897, if reduced by 30 per cent to represent the approximate discharge at Turners Falls, will develop 11,100 gross horse-power under the head of 39 feet. With good efficiency in canal, wheels and generators, 60 per cent of this, or 4,995 kilowatts, may be developed as electric current. It is not possible to say whether there is enough storage capacity behind the Turners Falls dam to make the entire minimum monthly discharge of the river available for power.

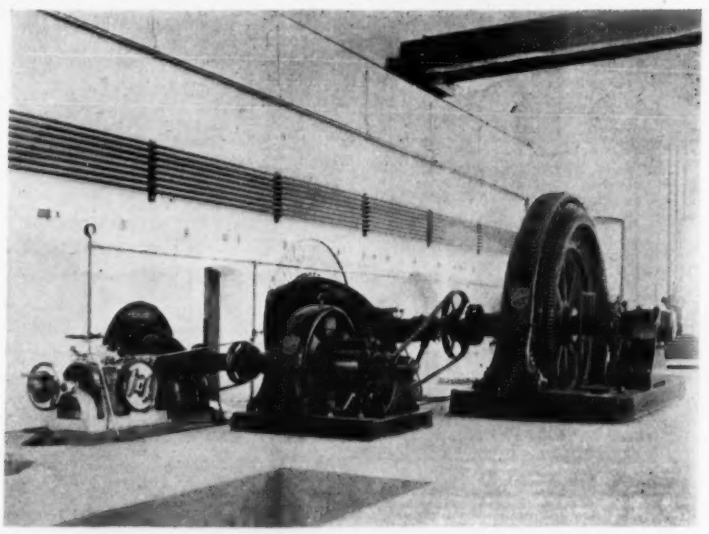


FIG. 6.—1000-KW ALTERNATOR AND EXCITER.

Armature Losses in Double-Current Generators.

BY ALFRED STILL, M. INST. E.E.

WHEN a single conductor is used to carry both an alternating and a direct current, the losses due its resistance will, at every instant be equal to the square of the sum of the two currents multiplied by the resistance. The mean total I^2R losses will, therefore, depend, not only upon the proportion which the virtual value of the alternating current bears to the total current, but also upon the shape of the current wave. If this be known, and the curve showing the instantaneous values of the alternating current be drawn in the usual way, it is merely necessary to lower the horizontal datum line by an amount representing the (steady) value of the direct current, to obtain a new curve, the ordinates of which, at every instant, represent the instantaneous value of the current in the conductor carrying the one current superimposed upon the other.

In the accompanying diagrams, curves of this kind have been drawn, and the I^2R losses calculated therefrom, with the object of giving a clear indication of what takes place in the armature windings of a double-current generator.

These curves give a graphical representation of the manner in which the armature losses diminish as the alternating current lags behind the e.m.f. induced in the windings, as the *power factor* is reduced, notwithstanding that the amount of the alternating current, or the *apparent* total output remains unaltered. This is a point that is well known to designers of double-current machines, but not always realized by the users.

Although the curves here reproduced no doubt indicate a graphical method of calculating the armature losses in double-current machines, it is not suggested that such a method would be practicable,

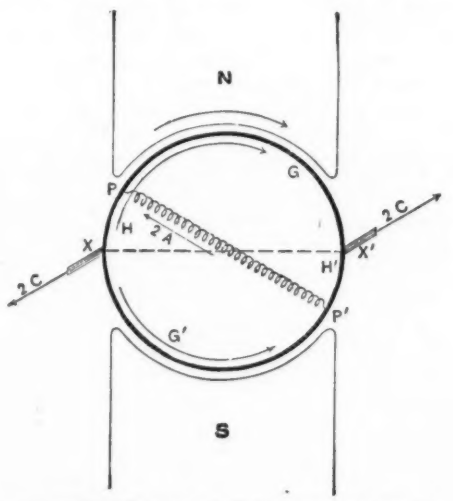


FIG. I.—RELATION OF CURRENTS IN ARMATURE.

being inconvenient and tedious; but, as already mentioned, it is believed that they will serve a useful purpose in illustrating the manner in which the current varies in the armature sections, and how the total armature losses are reduced with the shifting of phase at the lower power factors.

Although the effects are the same generally whether the machine gives polyphase, or merely single-phase currents, the very simplest case has been taken in order to avoid complication in the construction of the diagrams.

In Fig. 1 the heavy circle is intended to represent the armature windings of a two-pole dynamo in which the brushes are placed at each end of the horizontal diameter XX^1, the magnetic flux being in the vertical direction. The two slip rings, from which the alternating current is collected, are permanently connected to the opposite points, P and P^1, of the armature winding.

The armature is supposed to revolve in a clockwise direction, as indicated by the arrow on the pole face.

At the instant when the point P is under the left hand brush at X, the e.m.f. in the alternating-current circuit is at its maximum. As P moves round to X^1, the e.m.f. will gradually die down until, when the points PP^1 lie on the vertical diameter, it will be zero; it will then rise again, to reach its maximum value in the *opposite* direction when P comes under the brush, X^1, i. e., when the armature has gone through half a complete revolution.

Assuming the load on the alternating current side to be non-inductive, the current will be in phase with the e.m.f., and its maximum value will, therefore, be reached when the diameter PP^1 coincides with the line XX^1. But if the load is more or less inductive, the current will lag behind the induced e.m.f. and its maximum value will only be reached after the point P has traveled a certain distance from the point X. Under the extreme condition of a wattless load, i. e., a power factor of zero, and an angle of 90°—the maximum value of the alternating-current will only be reached when the points PP^1 lie on the vertical diameter.

Consider, now, the manner in which the current will divide itself in the armature sections.

If $2C$ be the total current in the direct-current circuit, independently of the alternating-circuit output—as flowing in the armature conductors between the brushes X and X^1 equally in the upper and lower parallel sections of the winding, as indicated by the arrows (Fig. 1). When an alternating current of $2A$ amperes is taken from the slip rings, this will also divide itself to right and left between the points P and P^1. It follows that the resultant current in sections H and H^1 of the armature windings will be $C—A$, while in sections G and G^1, it will be $C + A$.

Algebraically, if H, G, H^1 and G^1 stand respectively for the corresponding instantaneous values of the resultant current in the four sections, and bearing in mind that the total of all currents flowing towards a given point must necessarily equal the sum of all the currents flowing away from the same point, there is obtained

$$2C - H - G^1 = O \quad (1)$$

$$-2C + H^1 + G = O \quad (2)$$

$$2A + H - G = O \quad (3)$$

$$-2A - H^1 + G^1 = O \quad (4)$$

Adding together (1) and (3) we get,

$$2(C + A) = G + G^1 \quad (5)$$

and subtracting (2) from (4),

$$2(C—A) = H + H^1 \quad (6)$$

Also, owing to the symmetry of the arrangement, it is evident that $G = G^1$ and $H = H^1$; hence,

$$H \text{ (or } H^1) = (C - A)$$

and

$$G \text{ (or } G^1) = (C + A)$$

The diagrams of Figs. 2, 3 and 4 may now be drawn. The same values of e.m.f. current and armature resistance will be assumed throughout, the only variable being the power factor of the alternating current circuit.

In Fig. 2 the power factor ($cos\ \Theta$) is taken as unity (load non-inductive). In Fig. 3 it is .71 (angle $\Theta = 45°$) which might apply to a load of induction motors, although the power factor would rarely, in practice, be quite so low, and in Fig. 4, the extreme case of a power factor of zero has been taken. The alternating current in all cases is supposed to follow the sine law, and it is constant in virtual value, the *apparent* load or volt amperes on the alternating-current side remaining unaltered in the three examples.

In Fig. 2 the curve A has been drawn to represent half the total alternating current; its virtual value has been assumed equal to half the total direct current and its maximum ordinate will, therefore be $\sqrt{2}$ times C, or 1.41 C. Moreover, this maximum value will occur at the instant O, when the point P (Fig. 1) coincides with the point X. The horizontal distance from O to the vertical centre line represents half a complete period, i. e., the time occupied by the point P in traveling from X to X^1.

With regard to the horizontal line $C\ C$, this has been drawn below the datum line $O\ O^1$ at such a distance as to represent the value of half the total direct current.

If, now, we add the ordinates of the curves A and C we shall obtain the current curve indicated by the vertical section lines, and a little consideration will make it clear that the left hand half of this represents $(C - A)$, or the current in section H, while the right-hand half represents $(C + A)$, or the current in section G, the interval of time in each case being half a complete period. (It is understood that this time is measured from left to right between O and the vertical centre line for the current in section H, and between this centre line and O^1 for the current in section G. At the start—when the point P of Fig. 1 coincides with the point X—the current in the example chosen will be 41 amperes in section H and 241 amperes in section G, while at the end of the half revolution it will be 241 amperes in section H and 41 amperes in section G.) We are not concerned with the direction of the resultant currents, since this is of no consequence in the determination of the I^2R losses.

Observe, now, that as the point P travels away from X, the resistance of the winding in section H steadily increases from zero to a maximum amount, equal to twice the total armature resistance measured between brushes, while in section G it decreases from this same maximum value down to zero, which value will be reached by the time the point P has traveled round to X^1.

If, therefore, we draw the straight lines marked R R through the points O and O^1, as shown in Fig. 2, such that the maximum ordinate—representing, in this example, .02 ohms—falls on the vertical centre line, we shall be able to scale off the diagram the resistance in either of the two sections, H or G, which corresponds to any instantaneous value of the resultant current.

We are now in a position to draw the watt curve marked W on the diagrams. The ordinates of this curve are equal, at every point, to the square of the instantaneous value of the resultant current multiplied by the corresponding value of the resistance. The area of this curve will evidently be an indication of the amount of work done in heating the conductors of one-half of the armature; the portion to the left of the vertical centre line referring to section H, while the portion to the right refers to section G.

The average ordinate of the curve W for section H, added to the average ordinate for section G, gives the mean watts, or the mean rate at which work is being spent in heating the armature conductors forming the upper half of the winding between the brushes X and X^1. The same losses occur in sections H^1 and G^1, and the total watts lost in armature conductors will, therefore, be twice the above amount.

The following is the assumed data upon which the curves have been plotted:

Total armature resistance (between brushes) = .01 ohm.
Total direct current output ($2C$) = 200 amps.
Total alternating-current output ($2A$) = 200 amp.
Direct current pressure = 141 volts.
Alternating-current pressure = 100 volts.

Hence, direct current output = 28.3 kw and apparent alternating-current output = 20 kw, making a total of 48.3 apparent kw output, which is constant for all three diagrams.

These diagrams, Figs. 2, 3 and 4, show at a glance the appreciable reduction in the total I^2R losses which takes place as the power factor of the alternating-current decreases. The figures worked out from measurements taken on the diagrams are as follows:

For $cos\ \theta = 1$ (Fig. 2.)
Total real output = 48.3 kw.
Mean I^2R loss in section H = 370 watts.
Mean I^2R loss in section G = 370 watts.
making total for armatures = 1480 watts.

For $cos\ \theta = .71$ (Fig. 3.)
Total real output = 42.5 kw.
mean I^2R loss in section H = 150 watts.
mean I^2R loss in section G = 410 watts.
making total for armature = 1120 watts.

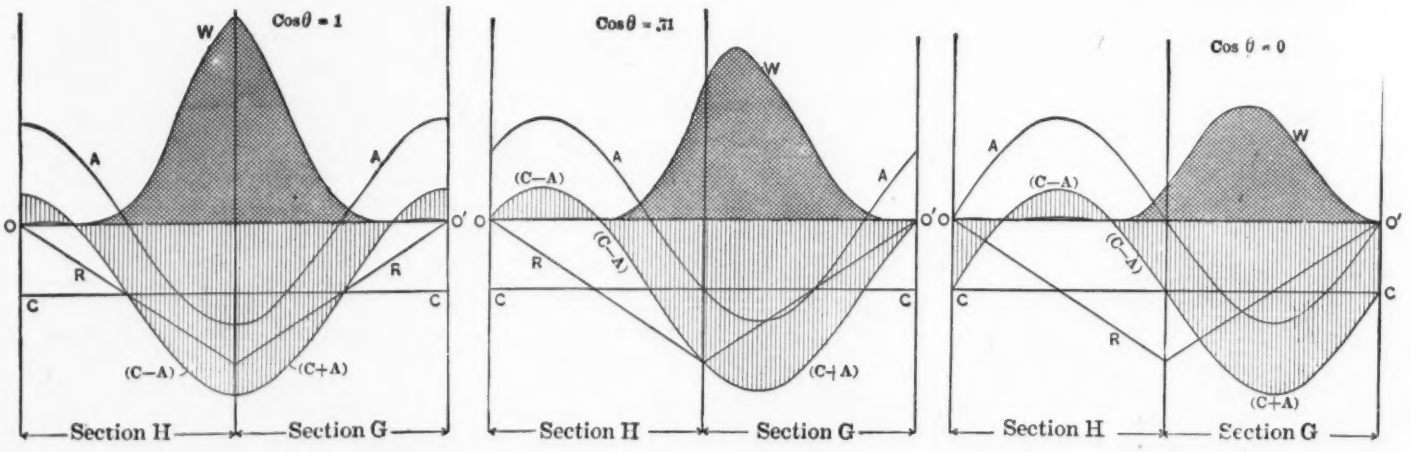
For $cos\ \theta = 0$ (Fig. 4.)
Total real output = 28.3 kw.
mean I^2R loss in section H = 30 watts.
mean I^2R loss in section G = 370 watts.
making total for armature = 800 watts.

The following figures are also interesting for the purpose of comparison:

If the total output of 48.3 kw. were taken out on the direct-current side only, the I^2R losses would be 1170 watts.

If, on the contrary, this same total output were all on the alternating-current circuit, the I^2R losses would be exactly double the above amount, or 2340 watts.

Again, if with output on the direct-current side only, this were reduced to 28.3 kw, corresponding to the real output in the previous example with $cos\ \theta = 0$ the total watts lost would be 400, or half the amount calculated from Fig. 4.



FIGS. 2, 3 AND 4.—DISTRIBUTION CURVES AT ANGLES OF LAG 0°, 45° AND 90°.

The Production and Utilization of Ozone.

BY ARTHUR W. EWELL, PH.D.

OZONE, an allotropic form of oxygen containing three atoms of oxygen, may be produced by three different methods: direct chemical reaction, electrolysis, and by the passage of electricity through oxygen gas. Ozone was supposed to be produced when oxygen was heated to a very high temperature, until disproved by Clement.[1]

A number of chemical reactions produce some ozone, particularly the slow oxidization of phosphorus. Moissan's method,[2] employing the action of fluorine on water, is the most promising, and if fluorine could be cheaply produced electrically, this might become an important method.

The electrolytic method has been carefully studied by Targetti[3] and Grafenberg.[4] Grafenberg found that sulphuric acid was the best electrolyte and Targetti that the best strength was 22° Baumé (or specific gravity 1.18). Any change in the nature of the cathode was found to be of little importance, but lead proved the most efficient material for the anode, and the production of ozone was found to be directly proportional to the anode current density and independent of the temperature when below 17° C. With a lead anode 1 cm. long and .5 mm. in diameter, in sulphuric acid of the above dilution, an e.m.f. of 7 volts gave a current of 2 amp. and 5.4 mg. of ozone were produced at the anode per hour. This is equivalent to 2.73 grams of ozone per hp-hour, which is far inferior to the results obtainable with the methods which will now be considered.

The direct electrical methods may be subdivided in two ways. First, as regards electrodes. The electrodes may be plates, wires or points or complex combinations. Secondly, they may be classified according to the method for preventing sparking and arcing, an obvious difficulty, since several thousand volts are required to force a suitable current through a gas.

The simplest apparatus is that of Tindal, which consists of two

(1) *Ann. der Physik.*, 14, 1904, p. 334; (2) *Centralblatt.*, 1899, II, p. 929; (3) *Nuovo Cimento*, 4, 9-10, '99, p. 360; (4) *Centralblatt*, 1903, II, p. 863; (5) *Electrical Review* (London), 55, p. 314; (6) *Elec. Rev.* (London), 55, p. 807; (7) *Journal für Gasbeleuchtung u. Wasserversorgung*, 1901, 30/31; *Electrochemical Industry*, 1903, p. 179; (8) *Elec. Rev.* (London), 55, p 1052; (9) *Electrochemical Industry*, 1904, p. 426; (10) *Electrochemical Industry*, 1904, p. 511; (11) U. S. Patent 754,261, Mar. 8, 1904; (12) *Journal of the Society of Chemical Industry*, 1898, p. 1173; (13) *Centralblatt.*, '97, I, p. 777; (14) *Electrician* (London), 1895, p. 213; (15) *Elec. Rev.* (London), 55, p. 1053; (16) *Journal for Gasbeleuentung u. Wasserversorgung*, 1901, 30/31; (17) *Electrical Review* (London), 56, p. 3; (18) *Zeit. für Electrochemie*, 1904, Jan. 1; (19) See also Ohio *Sanitary Bulletin*, Jan.-Mar., 1905) (20) *Centralblatt.*, 1902, II, p. 667; (21) *Centralblatt.*, 1904, I, p. 9; (22) *Berichte d. Deutch. Chemish. Gesell.*, XXXVI, p. 12; (23) *Ann. der Physik.*, 1902, 9, p. 1286.

parallel metal surfaces connected to the poles of a 50,000-volt trans- this air, partially transforms the oxygen into ozone. The efficiency is low, however, the yield being but 3 to 4 grams of ozone per kw-hour, and this method is not in use at the present time.[6]

An apparatus with wire gauze instead of the plates has been developed by Rosenberg and an output of 250 grams per kw-hour is claimed,[6] but as the air was not dried before entering the apparatus considerable nitrous oxide might have been formed and mistaken for ozone.

The Siemens & Halske apparatus differs from the Tindal in that one of the plates is covered with glass or mica, and the other plate is grounded and cooled by water. The plates, cylindrical or plane, have an area of several square yards. A difference of potential of from 8,000 to 15,000 volts is used. The apparatus is claimed to give an output of between 20 and 30 grams of ozone per hp-hour, with an ozone concentration of 2 grams per cubic meter of air.[7]

The Elworthy apparatus is similar to the Siemens & Halske except that both (cylindrical, concentric) electrodes are covered with glass and the air passes over each in succession. An output of from 60 to 70 grams per kw-hour is claimed, but the figures are doubtful, since the air was not dried.[8]

The Marmier-Abraham ozonizer has parallel, glass-covered, water-cooled electrodes, one meter square, at a difference of potential of 40,000 volts (alternating current). Air dried with pumice and sulphuric acid flows between the plates and 20 grams of ozone are said to be produced per hp-hour.[9]

In the Otto ozonizer one electrode consists of revolving beveled-edge discs. For half a revolution they are about an inch from an outer electrode and for the remainder the outer electrode is farther away and covered with glass. This increase in distance, together with the glass and the removal of two sectors of the discs, prevents arcing. A potential of 25,000 volts is used.

The very successful Vosmaer ozonizer remains to be described. One electrode is plane and grounded. The other carries a great number of points. A difference of potential of 10,000 volts (alternating current) is used and an output of 15 grams of ozone per kw-hour is obtained with an ozone density of 3 grams per cubic meter.[10] The air, previously dried with chloride of calcium, flows between the points and plate and the electric current (a small fraction of an ampere) partially ozonizes the oxygen.

An ozonizer must guard against sparking and arcing. The ozone is produced by a quiet electric current through the air. A spark, however, decomposes the ozone, and an arc destroys the apparatus. In the Siemens ozonizer glass plates are interposed between the electrodes. This necessitates a higher potential and an annoyance from breakage of the glass. The Marmier-Abraham apparatus uses an external spark-gap, the Otto a revolving electrode and the Tindal an external choking coil. Vosmaer uses the choking coil together with a condenser in shunt with the ozonizer and succeeds in obviating both sparking and arcing.[11]

Ozone has been tried with considerable success in ageing wines, in purifying beer kegs, in bleaching sugar, in purifying petroleum, in the manufacture of organic products, and most important of all, in purifying water. It is too expensive for a general bleaching agent,[12] it fails to completely decolorize sugar and molasses,[13] and it is unsatisfactory for purifying air.[14]

The Otto apparatus is used in France in the manufacture of organic products and has recently been installed in an experimental water purification plant at Niagara Falls.

The Marmier-Abraham ozonizer is in use in a brewery at Marseilles and at Lille in a water purification plant, which has been in operation since 1898, and which has been taken over by the city. The capacity of the plant is nearly a million gallons a day and the cost of purification is about $10 per million gallons.[15]

The earliest Siemens & Halske water purification plant was erected at the company's works at Martinikenfelde, near Berlin, to supply purified Spree water for a population of about 5,000. The water trickles through a tower filled with stones five meters high and one meter in diameter, while the ozonized air enters at the bottom and rises. Analyses by Dr. Erlwein[16] of the water before and after purification for a period of several days gave (per c.c.): Bacteria, before purification—maximum, 200,000; minimum, 2,300; average, 80,000. Bacteria after purification—maximum, 34; minimum, 0; average, 8. There was an increase of 12 per cent in air and 38 per cent in oxygen. All pathogenic germs were destroyed.

A similar plant was erected at Wiesbaden (Schierstein a Rh.),[17] but given up on account of a troublesome precipitate which the ozone formed with iron present in the water. Another Siemens & Halske plant has been in successful operation at Paderborn since August, 1902, supplying all the water for the town (about half a million gallons a day). About 1.3 grams of ozone is used per cubic meter of water and the total cost (interest and depreciation included) is about $15 per million gallons. Dr. Erlwein estimates that for a similar plant with a capacity of 10,000,000 gallons a day the total cost would be but $7 per million gallons.[18]. For comparison the total cost of purifying a million gallons of water by either slow or mechanical sand filtration is about $10 (estimate for Pittsburg, Pa.[19]). Sand filtration removes about 97 to 99 per cent of the bacteria.

The Vosmaer system has been in use at Nieuwersleuis, Schiedam and Rotterdam, Holland, and at Philadelphia. The crude water passes through a rough sand filter to remove suspended matter and enters the top of a tower about 30 ft. high; the ozonized air, forced through small holes in the bottom, rises in very small bubbles and comes into intimate contact with all the water. Special openings are provided for the outflow of the water at the bottom and the escape of the air at the top. Sufficient ozone is supplied to have a small excess in the escaping air. This system uses from one to five grams of ozone per cubic meter of water, depending on its condition, and the cost of operation is from $3 to $7 per million gallons of water.[20] Dr. H. J. van't Hoff (a prominent Dutch engineer, and a brother of Prof. van't Hoff) studied this system and found that the bacteria were reduced from 200-20,000 per c.c. to 1. Color and taste were removed from the water. Any residual ozone quickly decomposed. The amount of oxidizable matter in the water was greatly reduced. In brief, this purification appeared to remove practically everything except industrial contamination. The reliability of the apparatus has been illustrated at the Schiedam plant, which was in continuous operation with no interruption, eleven hours a day, for two periods of six months each. The Philadelphia plant is in the heart of the city and successfully purifies a million gallons a day of the very polluted Schuylkill River water. It is owned by the United Water Improvement Company, which holds the American patents of Vosmaer and Lebret. One of the towers is of glass and the process of purification may be clearly seen. Dr. Rivas, of the Water Department of Philadelphia, has recently made a careful test of this plant. He found that the number of bacteria was reduced from about 1,500,000 per c.c. to 38-55, when 10,000 gallons were being purified per hour, and that these remaining bacteria were all harmless, disease germs being totally destroyed. This selective action of ozone is very interesting and important. Such action is not found in sand filtration.

The present applications of ozone point to greater importance in the future, but the wide diversity in apparatus and efficiencies (claimed) suggest still more extensive possibilities when the nature of the production is better known.

Probably ultra-violet light is an important factor in the electrical production of ozone. Certainly it strongly absorbs ultra-violet light[21] and is produced in considerable amount outside a tube in which an electric discharge is occurring if the tube is of quartz, which is permeable to ultra-violet light, while outside a tube of glass, which is impermeable, little ozone is produced.[22]

Ozone is not a stable gas, but gradually decomposes to oxygen. Prof. Warburg[23] has shown that the deozonizing increases with the temperature and the concentration. The greatest concentration ever obtained was 85 per cent, by Ladenberg, by fractional distillation of liquefied, ozonized oxygen. Prof. Warburg's results show that at ordinary temperatures about 1 per cent of ozone of such a concentration would decompose in two hours and 50 per cent in about ten days.

As the ozone breaks down into oxygen rays are emitted very similar to the rays from radium, since they act on a photographic plate, make air electrically conducting, and cause fluorescence.

Wireless for Train and Steamer.

The Midland Railway system of England has installed wireless telegraphy for its service between the coast of England and the Isle of Man. There is a great deal of holiday and excursion travel, rendering it necessary to watch closely the movements of train and steamer, regardless also of fog. The installation has been made with Lodge-Muirhead apparatus, and the results are reported as being satisfactory. The system is worked in connection with regular telegraph land lines.

Data on Electric Baking with Niagara Power.

ELECTRICITY bakes a pound of bread with a consumption of 3,685 watt-hours in the plant of the Natural Food Co. at Niagara Falls. To bake the same weight of bread in an oven heated by combustion the company uses 0.3306 pound of anthracite coal. Bread in this case is the entire wheat kernel, shredded, and then baked without the addition of any other substance. The bread baked with coal is known simply as "shredded wheat biscuit," and the electric baking produces "triscuit."

All of the processes necessary to transform the best Genesee Valley white wheat into the finished product are carried on with the aid of electric energy in the factory of the Natural Food Company at Niagara Falls. The plant has already been illustrated and described in the ELECTRICAL WORLD AND ENGINEER, but a few items may be here recapitulated. This factory is located on Buffalo Avenue, adjoining the State Reservation and facing Niagara River. The building is 466 feet long by 66 feet wide and four and five stories in height. All mechanical power in this plant is supplied by electric motors, all lamps are electric, and a large share of the baking is done with that form of energy. This electric energy comes from the time it falls in an irregular way to the minimum of 210 kilowatts. From all this it may be seen that the mechanical processes through which the wheat passes require rather large powers.

Perhaps the single operation that consumes more power than any other is that of shredding the wheat, which is done by passing it between pairs of steel rollers. One roll of each pair is smooth and the other has twenty circular corrugations per inch, so that wheat in passing between the two is spun into shreds. Before it goes to the shredder the wheat is steamed for 35 minutes in revolving wire kettles, and from the shredder it drops to an endless belt and is carried to the electric oven, or else goes to the cutter and is divided into biscuit for the oven that is heated by combustion. During a certain period the number of shredded wheat biscuits baked by combustion was 1,169,344 dozen. The weight of each of these biscuits when quite dry was nearly one ounce, or substantially 887,000 pounds for the entire lot just named. Biscuits baked with the heat of combustion really pass through two ovens. In the former the biscuits are placed on wire pans which are suspended in a sort of Ferris wheel, so that they revolve slowly for 30 minutes over a great bed of coals, in air and gases that have a temperature of about 450 deg. F.

FIG. 1.—VIEW OF END OF ELECTRICAL OVEN. TRANSFORMERS LOCATED ON PLATFORM ABOVE.

plants of the Niagara Falls Power Company, about 3,500 feet distant, in the form of 2-phase, 25-cycle, 2,200-volt current, and is received in 18 transformers of 2,300 kilowatts total capacity. Four of these transformers, rated at 75 kw each, deliver current for incandescent lighting at 115 volts and 25 cycles. Another four transformers of 150 kw each supply 440-volt current to induction motors, and also current for a rotary converter of 220 volts. For the electric ovens there are ten transformers of 140 kw capacity each. Two of these transformers are required for each oven, and there is thus one extra pair. Machinery throughout the plant is driven by 87 induction motors that range from 1 to 40 horse power in individual rating and have a combined capacity of 560 horse power. Besides motors of the induction type there are several taking direct current at 220 volts from the rotary converter, and operating elevators. A 12-kw motor generator charges storage batteries for electric bells and telephone circuits. Some parts of the factory operate day and night, and the electric load from about 6.30 p. m. to 6.30 a. m. remains nearly constant at 210 kilowatts. Within an hour after 6.30 in the morning the load rises to more than 700 kilowatts, and, with the exception of a drop during the noon hour, ranges from that figure to more than 800 kilowatts until about 5 p. m. After that

After this baking process the biscuits are carried slowly through a drying oven that is about 150 feet long and has a temperature of 200 to 300 degrees. The trip from end to end of this second oven takes about one and one-half hours, so that the entire baking process in an oven heated with fuel consumes about two hours. During the same period in which the 887,000 pounds of shredded wheat biscuit were baked there were burned in the first or high temperature oven 169,000 pounds of anthracite coal, stove size, and for the second or drying oven 120,960 pounds of anthracite pea coal. The total weight of anthracite coal consumed to completely bake the 887,000 pounds of shredded wheat was thus 289,960 pounds, or 0.3306 pound of coal per pound of wheat product. Of this 0.3306 pound of anthracite coal 0.1927 pound was stove size and 0.1379 pound was pea size. If the anthracite stove coal cost $5 per short ton and the pea coal $3 per short ton, the cost of the fuel consumed to bake one pound of the shredded wheat was 0.0687 cent.

One of the electric ovens for baking the shredded wheat in the form called triscuit turns out about 2,483 triscuit per hour. The weight of these triscuit is substantially one-half ounce each, which gives the hourly product a total weight of 77.6 pounds. Energy consumption in the electric oven varies a little in rate, according

to the velocity at which the triscuits are moved through it between series of electrically heated links that do the baking. For each oven there is an ammeter in each phase of the two-phase circuit that supplies the electric energy to the transformers at 2,200 volts. While one of the electric ovens was automatically turning out tris-

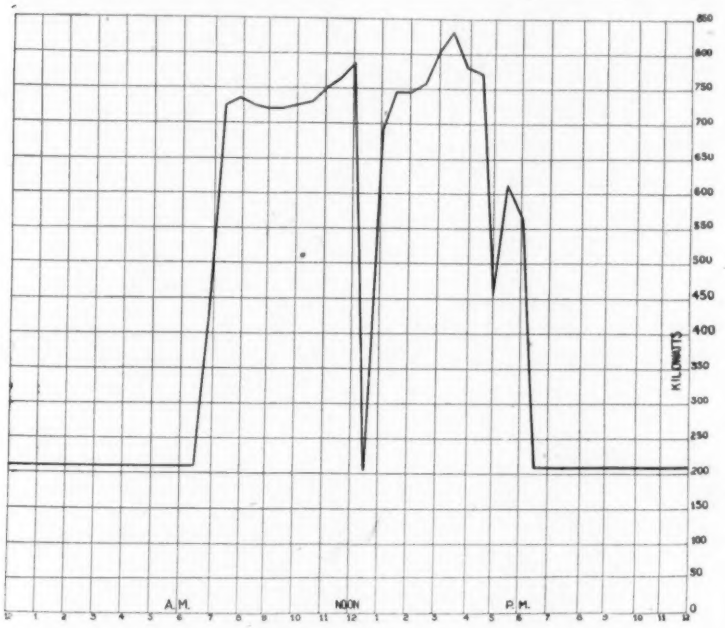


FIG. 2.—CONSUMPTION CURVE.

cuits at the rate above named, the writer and Mr. W. C. Marlow, electrical engineer of the Natural Food Company, read the ammeters and found their approximate indications to be 60 and 70 amperes, respectively. At 2,200 volts these readings represent an input of 286,000 watts at the primary sides of the two transformers. This rate of work was baking 77.6 pounds of triscuits per hour, and the consumption of energy was therefore 3,685 watt-hours per pound, including the losses in the transformers. One watt-hour is the equivalent of 3.4383 heat units, so that the 3,685 watt-hours required

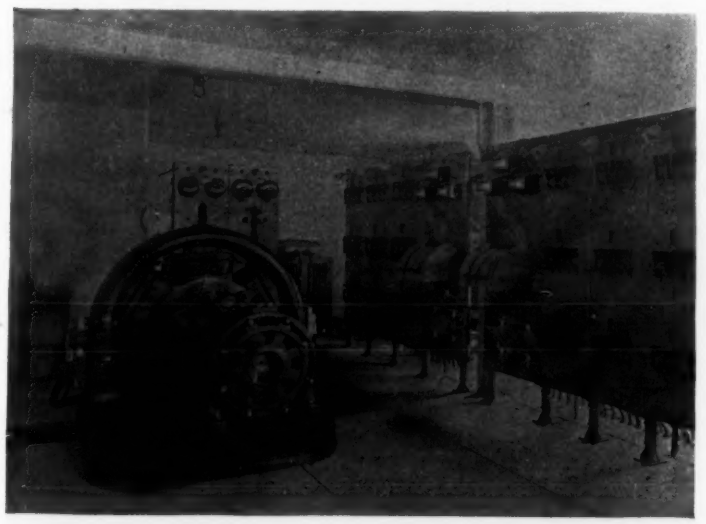


FIG. 3.—EAST TRANSFORMER ROOM.

to bake one pound of triscuit must develop 12,670 units of heat. With perfect combustion one pound of anthracite coal yields about 12,000 heat units, and on this basis the 0.3306 pound of coal consumed in baking one pound of shredded wheat biscuit would develop heat to the extent of 3,967 units. But combustion is never perfect in an ordinary furnace, and as much as 25 per cent of the heat actually developed escapes with the flue gases in most cases. It seems most probable, therefore, that not more than 70 per cent of the latent heat of the coal does any useful work in baking the shredded wheat. This assumption reduces the useful heat to 2,777 units per pound of wheat. If electric energy operating on same material of high resistance was to replace coal in the furnaces where the shredded wheat is baked by exposure to radiant heat and to hot air, the entire equivalent of the electric energy would be as useful as the 70 per cent of the latent heat of coal named above. Seventy per cent of the latent heat of the 0.3306 pound of coal necessary to bake one pound of shredded wheat, amounting to 2,777 units, is the equivalent of 807 watt-hours. The assumed cost of this coal was 0.0687 cent, and the rate for electric energy to replace the coal at an equal cost is 0.0840 cent per kilowatt-hour. In favor of the electric heat is the fact of a saving as to the labor of handling coal. On this suggestion the shredded wheat would continue to be baked by radiant heat and hot air, and not by contact with heated surfaces.

Subsidiary Apparatus of the Telefunken System.

By A. Frederick Collins.

THE combination of the Braun, Siemens & Halske and Slaby-Arco systems of wireless telegraphy not only required a rearrangement of the oscillator and resonator circuits, as indicated in a prior article in these columns, but many of the devices were redesigned to fit the new order of things, and hence are not without their especial interest.

In the Telefunken system the induction coil with a simple spring vibrating interruptor has been retained for stations where the range to be covered is not more than 150 kilometers, and this type answers satisfactorily where the initial energy does not exceed 350 watts and the primary can be wound for potentials up to 110 volts direct current.

Where greater distances are to be bridged an induction coil that takes from 350 watts to 1.5 kilowatts is employed, and this is operated on either a 50-cycle, single-phase current or an interrupted direct current; in the latter case a mercury turbine interruptor, with

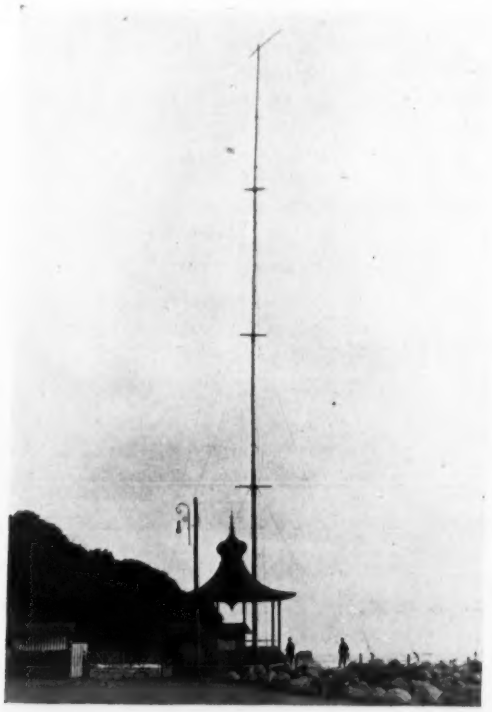


FIG. 1.—MAST.

a suspension system, where used on board ship, is employed. In the first case a rotary converter consisting of the usual direct-current motor and alternating-current generator is used, although in practice the direct-interrupted curent has met with favor, for the dynamo is not subjected to the dangerous strains that so frequently disrupt the latter.

In portable stations, or where a suitable current is unavailable, a motor-generator set is installed, but where a converter is used the motor is provided with a starting commutator so that when the operator is receiving, the motor is not only cut out, but stopped as well; and before transmission is again possible, the commutator must be returned to its original position.

The key for breaking the primary current into the signalling code still retains the proportions originally given it by Marconi, but the

German make is fitted with an electromagnetic blow-out or with an automatic minimum current cut-out, i. e., the circuit is shunted by a coil of wire having a small cross-sectional area. In stations utilizing large currents of more than 40 amperes a number of platinum contacts are connected in multiple.

The spark-gap furnished with this system is of the multiplex type—that is, they are subdivided; for portable stations these consist usually of three air-gaps and are not enclosed, while for permanent station work the discharger is enclosed in a felt casing so that the sounds may be deadened, but provision has been wisely made so that the interior is ventilated.

The high-frequency or excitation circuits, which are made up of the multiplex discharger, the Leyden jar battery and variable inductance are similar to those introduced by Dr. Slaby; that is, the Leyden jars are contained in a case, the coil is wound on the outside and the spark-gap located on top so that the three devices form a compact unit. The standard station type, which has proven so very successful on board ship, permits the wave length to be charged from 120 meters up to 1,000 meters.

In the portable type of oscillators only two wave lengths may be produced and this is accomplished by means of plugs or spring jacks. To the circuit exciters of either type there is attached an aerial switch for cutting out the oscillator systems from the aerial wire and switching in the resonator circuits, thereby changing the radiator into an antenna.

The coherer that has been adopted as best able to withstand the constantly changing meteorological conditions that work havoc with the average detector, is of the granular steel type and has a V-cut so that the degree of sensibility may be varied, and in this way rendered equally suitable for short or long-distance work. Moreover, this coherer possesses remarkable constancy and exceptional permanence, which are among the first requirements for commercial telegraphy. Its design is such that it can be easily and quickly replaced by another, for projecting from the supports of the tapper are two spring clips and all that is necessary is to draw out the one and insert the other.

The coherer is used in connection with a carefully balanced polarized relay previously tested in a circuit of 1.4 volts and which includes a resistance of 100,000 ohms. Two of the most serious difficulties found in polarized relays have been overcome, namely, the "dead" movement and the effects of the constant tapping of the coherer. The decoherer is actuated electrically but operates mechanically, so that the strength of the stroke is always uniform. The spring motor of the tapper has been reduced in size and the movement of the vibrator has been greatly increased.

In all the different forms of receiving apparatus where there are movable parts, it has been the aim of the makers to avoid delicate mechanisms that have heretofore characterized the construction of wireless telegraph appliances, for herein lies the weakness and instability of nearly all other systems; on the other hand, the German company has striven above all things to produce a set of instruments that will stand the treatment usually accorded them by the average telegrapher and yet work the same to-day, to-morrow and every day thereafter.

Proper switching devices largely contribute to the accuracy and wear and tear of the instruments; for this reason a main switch

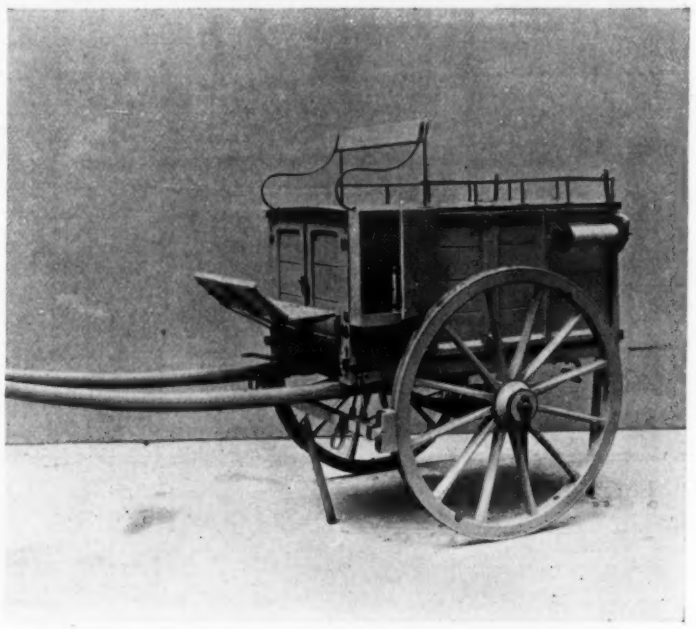
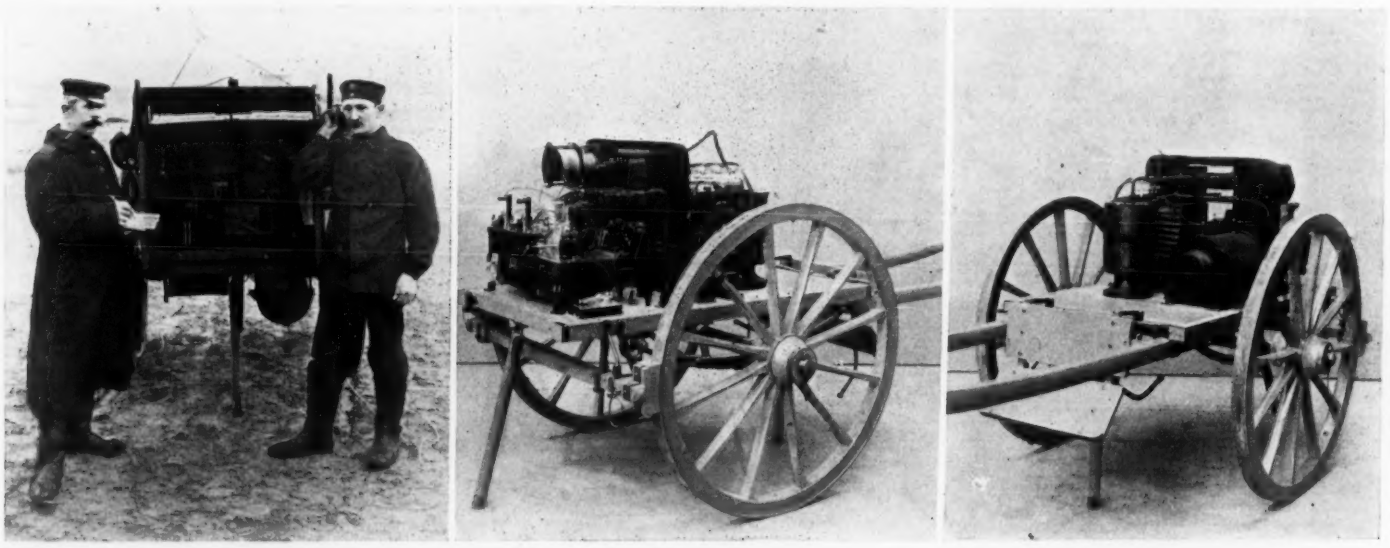


FIG. 5.—FIELD OUTFIT.

on the receptor is introduced to cut out all the internal circuits of the receiving station and to exclude the current energizing the transmitter. By employing polarization cells and ohmic resistances sparking at the relay and other contact points is entirely obviated.

The receivers of the ship sets are fitted with springs to take up the vibration due to the engines. The transformers for transfering the energy of the oscillations from the open to the closed circuit of the receivers consists of a single layer of wire equipped with sliding contacts so that any number of turns may be rendered inductive. Of this type of transformer there are three sizes made, the smallest of which may be adjusted to a wave length of from 50 to 200 meters; the intermediate size, which is the kind supplied to the United States Navy's ship sets, has a range of from 200 to 600 meters and the largest make from 600 to 3,000 meters.

With these transformers tuning to the desired wave length of the transmitter is easily effected. Where only a given wave length is required, the resonator transformers are furnished with a movable primary winding and any degree of sensitivity from zero to maximum may be had, in the first instance by withdrawing the primary from the secondary, and in the second case by adjusting the coils so that their mutual inductive effects will be greatest.



FIGS. 2, 3 AND 4.—TELEFUNKEN FIELD OUTFIT.

The coherer and writing indicator may be replaced by an electrolytic detector and a pair of head telephone receivers, as described in these columns of March 11, 1905. Ondameters for measuring the wave-length, also previously described, accompany the sets, so that tuning to resonance is not left to the mere judgment of the operator but may be determined with absolute precision.

Aerial wires for permanent stations are preferably made of phosphor-bronze in virtue of its mechanical strength, and these are insulated at the upper extremity by porcelain heads instead of ebonite, since the latter material has not proven very durable in places where moisture is present. The lower portions of the aerials leading to the interior of the stations are insulated to a greater or lesser extent, according to the potential employed; the aerials are directly earthed through a lightning switch which during a thunder storm saves the instruments from its destructive action and it also acts as a conductor for equalizing the difference of potential that exists between the air and the earth.

Equipments of the foregoing system have been installed throughout the world and the German, United States and Swedish navies

FIG. 6.—APPARATUS OF THE TELEFUNKEN SYSTEM.

have equipped ships with it. Italy and England are the only other powers that have adopted a specific make of apparatus, these using the Marconi system, while Russia and Japan have purchased equipments from nearly every company engaged in their manufacture. In nearly every civilized country, too, experiments are going on with portable wireless sets, and German instruments are at work in every climate, be it frigid, temperate or tropical.

As the primary object of the German instrument makers was to provide appliances for the army and navy, the Telefunken system has been developed under the eyes of the military authorities, and since the devices have met the severe demands made in warfare it is reasonable to believe that they would be no less serviceable in the field of commercial activities.

One of the most difficult tasks the wireless telegraph engineer has to perform is planning and estimating the size and power required to bridge specific distances. These vary within wide limits, due chiefly to the character of the country between the stations, the atmospheric conditions and especially to the presence or absence of water. Instruments are usually standardized by the distance they will cover across water.

Even under such circumstances any figures that are given must be treated as provisional, as some factors must of necessity be ignored, such as the vertical length and number of the wires forming the aerials, the nature of the weather, etc. As an illustration, one of the signalling sets designated by the company as No. 100 has a range of 100 kilometers over water between ships when the aerial of each has a height of 40 meters and is composed of two or three parallel wires. Now, if the same equipment is used and the aerial is formed of 15 or 20 wires spread out in the form of a fan, it then becomes possible to telegraph nearly twice the distance.

Again, an apparatus of the above type may operate satisfactorily in fair weather to a distance of 100 kilometers, and during foggy or damp night air the range will be increased 30 or 40 meters, while in excessively dry and hot weather the signalling distance may fall off 30 or 40 meters. In purchasing apparatus all these variations from the normal should be fully considered and the data given by the manufacturers should be taken to represent the mean distance.

Where the transmission is to take place across land, the variations are even greater, and it is practically impossible to determine sizes of apparatus and calculate the power required unless the conditions of the land between the stations are known. If the country is well built up or heavily wooded or the profile as the crow flies is rugged, then the apparatus for signalling must be of sufficient size and power to telegraph three or four times as far as over water.

Oppositely, if the country is open, flat and moist, the energy required to bridge a given distance may be roughly assumed to be the same as for an equal distance over water. In sparsely-settled countries, as Alaska, the wireless telegraph may be utilized to advantage, but under usual circumstances it is unable to compete with the wire telegraph or telephone. Its mission is to supplement these modes of transmission, not only between ship and ship and ship and shore, but between fixed stations in competition with the cable, where the distance is not too great, when its initial cost and subsequent upkeep will be found to be very much less than that of the submarine cable.

A Method for Determining the Size of Transmission Circuits.

BY C. W. STONE.

IT is believed that the short method given below for determining the size of conductors necessary for three-phase transmission lines, which experience has shown to be of considerable value, will prove of sufficient interest to justify its publication.

The tabulation is based on the transmission of 100 kw, and there has been assumed an energy loss of 10 per cent and a power factor of 85 per cent. Ten per cent energy loss has been assumed as being approximately the maximum which would ordinarily be allowed. The value assumed for the power factor is fairly close to that found in the average transmission circuit.

The formula which has been used for calculating the values given in the table is as follows:

$$D = \frac{P E^2 A}{C W}.$$

D = Distance one way in feet.
P = Percentage of energy lost in the line.
E = Delivered voltage.
A = Cross-section of each wire in circular mils.
W = Number of watts delivered.
C = A constant whose value depends upon the power factor.

The value of C for a three-phase circuit operating at a power factor of 85 per cent is 1,500. On the basis of these assumptions the distances of transmission have been determined for the various voltages commonly employed and for the different standard sizes of wire, from No. 6 B. & S. to a conductor having an area of 500,000 circular mils, as is indicated in the table on the next page.

The method of using the table can best be illustrated by an example:

Example.—500-kw to be delivered 12 miles with 10 per cent of energy loss, at 85 per cent power factor; the delivered potential to be 6,000 volts.

As the tabulation is based on 100 kw, it will be readily seen that in the case assumed there is five times the amount of power to be transmitted. Referring to the formula, it will be noted that 100 kw can be transmitted over a circuit five times as far as 500 kw under the same conditions with the same losses. In this case there is 500 kw. to be transmitted 12 miles. Thus if 12 be multiplied by 5, there is obtained a value which is equal to the distance to which 100 kw can be transmitted over a certain size of wire, with losses as given above. Referring to the table under the column "6,000," there is found a value 60.44, which is opposite No. 00 wire, which is the size of wire to be determined. In other words, 100 kw can be transmitted for 60.44 miles with an energy loss of 10 per cent at a power factor of 85 per cent, with 6,000 volts at the receiving end, or 500 kw can be delivered at the end of a 12-mile line with the same losses and with the same delivered potential over the same size wire.

In case it is desired to allow a smaller percentage of energy loss,

it is only necessary to take the ratio between the energy loss and the 10 per cent energy loss on which the table is based. For instance, if it is desired to allow only 5 per cent loss, it would be necessary in the above table to multiply the value 60 by 2, which equals 120. Again referring to the table under the 6,000-volt column, it will be noted that it will require a wire between 250,000 and 500,000 circular mils. In most cases this size of wire would be prohibitive, and it would be necessary to use a higher voltage. If there be selected a delivered potential twice as high, i. e., 12,000 volts, it will be noted that under the 12,000-volt volumn a value 120.16 is found opposite No. 2 wire, which is the size to be determined.

Number of wire. B. & S.	Area, wire C. M.	Distance of Transmission for Various Potentials at Receiving End. 2000	3000	4000	5000	6000	8000	10000	12000	15000	20000	25000	30000
6	26250	1.32	2.98	5.28	8.27	11.92	21.12	33.1	47.68	74.50	132.4	206.75	298
5	33100	1.66	3.75	6.64	10.40	15.00	26.56	41.6	60.00	93.75	166.4	260.00	375
4	41740	2.10	4.74	8.40	13.15	18.96	33.60	52.6	75.84	118.50	210.4	328.75	474
3	52630	2.54	5.96	10.16	16.55	23.84	40.64	66.2	95.36	149.00	254.8	413.75	596
2	66370	3.33	7.51	13.32	20.85	30.04	53.28	83.4	120.16	187.75	333.6	521.25	751
1	83690	4.21	9.48	16.84	26.32	37.92	67.36	105.3	151.68	212.00	421.2	658.00	948
0	105500	5.29	11.92	21.16	33.10	47.68	84.64	132.4	191.72	298.00	529.6	827.50	1192
00	133100	6.71	15.11	26.84	41.97	60.44	107.36	167.9	241.76	377.75	671.6	1049.25	1511
000	167800	8.45	19.04	33.80	52.85	76.16	135.20	211.4	304.64	476.00	845.6	1321.25	1904
0000	211600	10.62	23.92	42.48	66.42	95.68	169.92	265.7	382.72	598.00	1062.8	1660.50	2392
	250000	12.58	28.33	50.32	78.67	113.32	201.28	314.7	453.28	708.25	1258.8	1966.75	2833
	500000	25.17	56.66	100.68	157.35	226.64	402.72	629.4	906.56	1416.50	2517.6	3933.75	5666

Recent Electrochemical Developments.

ELECTROLYTIC PROCESSES.

In the Hall process of making aluminum, the electrolyte is a solution of alumina in a fused mixture of croylite and aluminum fluoride as solvent. The anodes are made of carbon. The electrolytic reaction decomposes the alumina and gives aluminum as cathodic product and carbonic oxide as anodic product. In this process it is important to have a pure electrolyte. Anson G. Betts, in a recent patent, endeavors to make the electrolytic production of aluminum analogous to the process of copper refining and as a special advantage of his process he claims that it is not necessary to purify the ore before the metal is reduced from its oxide. His cell consists of three layers of fused materials separated from each other by the differences of specific gravity. The highest and lightest layer is fused aluminum, forming the cathode, the middle layer is the fused electrolyte and the lowest and heaviest layer is the fused aluminum ore with its impurities, which forms the anode. Since aluminum is most easily oxidized of the metals present in this mixture, it alone dissolves from the anode so that the resultant electrolysis is that pure aluminum is deposited at the cathode while fresh aluminum passes from the anodic mixture into the electrolyte. If the aluminum is deposited on a cathode of zinc, tin or aluminum bronze so as to form a liquid alloy at a temperature below the melting point of aluminum, other baths than the fluoride bath of the Hall process may be used, for instance, an electrolyte of fused sodium-aluminum chloride.

The same inventor has taken out a patent for parting precious metals. It is, of course, well known that electrolytic copper refining gives not only very pure copper, but leaves the anode slime in such a condition that silver and gold may easily be extracted from the same. Two processes—those of Moebius and Balbach, respectively—are in commercial use for this purpose. A. G. Betts patents the use of an electrolyte consisting of a strong non-oxidizing acid, together with the silver salt of this acid with a very small addition of such substances as gelatine and gum arabic to prevent the growth of trees. The silver is deposited on the cathode, the gold remains back at the anode (which it is not necessary to wrap up in cloth) while bismuth, etc., go into solution. When the solution has taken up sufficient of the impurities it is withdrawn. As a suitable electrolyte a solution of silver methyl sulphate and methyl sulphuric acid is mentioned.

C. M. Hall patents a stopper for the tap hole of pots containing fused electrolytes. It consists of a tapering metal plug which is driven into a body of plastic material of powdered carbon and tar previously placed in the tap hole. The plug is driven into a plastic body before the latter has become hard. The method of tapping is stated to be greatly facilitated by this apparatus.

MISCELLANEOUS.

E. D. Kendall patents a process of making tungsten steel free from carbon by reducing tungsten ore with zinc dust and alloying the reduced metallic tungsten with variable proportions of iron by one operation in an electric furnace.

D. R. S. Galbraith patents a process of making steel from iron sand, oxide of iron, etc., in an electric resistance furnace. As noticed in the Digest of this issue, his furnace was recently exhibited in London.

E. Langguth patents mechanical details of an electromagnetic ore separator, while a patent of D. L. Winters refers to mechanical details of construction of primary cells.

Nearly forty years ago Berthelot discovered that when powerful sparks from an induction coil are passed through a mixture of acetylene and nitrogen, prussic acid is produced and carbon is separated, but the efficiency is very low. W. Muthmann has recently patented a process which is a modification of that of Berthelot. He produces prussic acid by passing a gaseous mixture of nitrogen and hydrocarbons (cheap ones) through a high-voltage flame and immediately removing the products formed.

E. C. Paramore has patented a process by which he states the bleaching properties of ordinary chlorine gas are increased, while it is divested of its disagreeable odor. To this end he subjects streams or currents of dry chlorine gas to electric discharges of high tension passing through dielectric partitions with an exclusive passing of air.

A recent patent of R. M. McFarland relates to details of construction of a safety electric switch system for blast furnace hoists.

English and German Trolleys.

Discussing the relative importance of English and German electric street railway development, the London *Electrician* says: "While 510 miles of new route were added to the traction system of Germany between October 1, 1899, and October 1, 1900, the corresponding figures for the next years fell to 143, 180, 190 and 60 miles respectively. On October 1, 1904, up to which date the German tables have been corrected, the total length of single track of electric traction of all descriptions amounted to 3,525 miles. According to our own traction tables (published February 3, 1904), which refer to the state of conditions in the United Kingdom on January 1st of this year, the total length of track of electric tramways and railways came to, approximately, 3,000 miles. We are thus not so far behind Germany in this matter as people would have us believe; in fact, when the size of the two countries is taken into account, we are far in advance. In the United Kingdom there are 0.025 miles of electric tramway or railway per square mile, in Germany only 0.017. Probably also the British electric tramways and railways already carry more passengers per annum than the German ones."

LETTER TO THE EDITORS.

Booster Feed Control.

To the Editors of Electrical World and Engineer:

SIRS:—If Mr. Lamar Lyndon will kindly refer to my article in the issue of June 24 he will see in the second line that there is no claim for originality (merely because the arrangement is so self-evident, although it happened never to have been brought to my notice). Nevertheless, the method was unknown on the test floor of a large electrical manufacturing company until introduced there by myself more than two years ago, in the form of two rheostats, one as a potentiometer, the other as a series resistance; and this arrangement, by dispensing with the large number of rheostats formerly used, and by giving a quick control of the field, has since been generally adopted.

PITTSBURG, PA. CARL P. NACHOD.

DIGEST OF CURRENT ELECTRICAL LITERATURE

DYNAMOS, MOTORS AND TRANSFORMERS.

Double-Field Alternating-Current Generators.—ZIEHL.—A paper read before Association of German Electrical Engineers on a new type of alternating-current generator. The essential feature is that both rotor and stator participate in the generation of energy. To explain the action of the machine the author first discusses the behavior of slip-ring induction motor, the rotor of which is not permitted to assume its natural speed, but which is driven with a certain speed from the outside. If z_1 is the frequency in the stator winding, z_2 the frequency in the rotor winding, $2p$ the number of poles and n the relative speed per second of the rotor with respect to the stator, then $z_2 = z_1 + p\,n$. There n is counted positive if opposite to the direction of rotation of the rotary field. If $n = 0$, $z_2 = z_1$, the machine acts as a transformer. With increasing n (positive, i. e., the rotor being driven opposite to the rotation of the rotary field), the frequency z_2 in the rotor increases and the machine acts partly as transformer and partly as generator, i. e., the fraction $z_1 \div z_2$ of the total electrical energy generated is supplied from electrical energy from the stator transformer action and the fraction $p\,n \div z_2$ is supplied from mechanical energy (generator action). If the stator is revolved in the same direction as the rotary field (n negative), z_2 first decreases with increasing absolute value of n, it becomes zero, for $z_1 = p\,n$, and then its absolute value increases again and z_2 becomes equal to z_1 when the speed of rotation of the rotor is twice the speed of rotation of the rotary field, i e., $p\,n = 2\,z_1$. This fact that the frequency in the stator becomes equal to the frequency in the rotor in this case, suggests to use both stator and rotor for generation of energy. Now, let us assume both stator, a, and rotor, b, each with identical three-phase windings to be at rest, as in Fig. 1A, and let us assume that by some means we

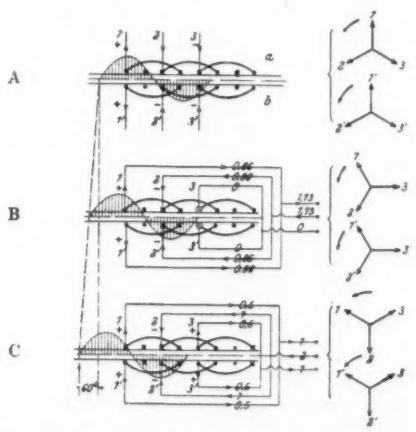


FIG. 1.—DOUBLE-FIELD, ALTERNATING-CURRENT GENERATOR.

bring a revolving magnetic field into the machine (direction to the left). Then the instantaneous current values are as plotted in the diagram at the right hand. In Fig. 1 *B* the field has progressed 30 degrees from the position in Fig. 1 *A*, and in Fig. 1 *C* further 30 degrees more. It will be seen that the currents are equal and in phase and may therefore be connected in parallel, as shown in Fig. 1 *B* and *C*. While in Fig. 1 both rotor and stator are at rest, we will now assume that the rotor *b* revolves in clock-wise sense with a speed double that of the field and opposite to the same. The stator windings are then cut by a magnetic field which revolves in a direction opposite to that assumed in Fig. 1 (at rest). The e.m.f.'s are reversed and the currents flow in reversed direction. Fig. 2 represents this case of revolving rotor and shows that the currents in the rotor winding are the same as in Fig. 1, while the currents in the stator are reversed. To connect the windings in parallel, a different method is now required, as indicated in Fig. 2: the rotor phases are reversed and the stator phases 2 and 3 are exchanged. Under these conditions the phase currents in the two windings of stator and rotor are opposite to each other and there can be no armature reaction whatever; the machine is naturally compensated. The author then gives the analogous considerations for two phase and single phase. Now the problem is to bring a revolving field into the machine as required. The simplest method is to provide a special winding for this purpose. This is shown as 4, 5, 6 in Fig. 3, where the winding is placed on the rotor. But it might just

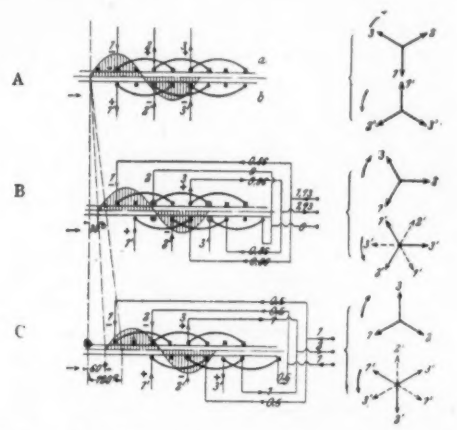
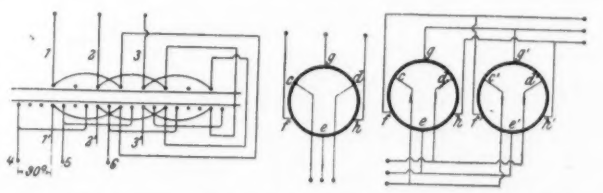


FIG. 2.—DOUBLE-FIELD, ALTERNATING-CURRENT GENERATOR.

as well be placed on the stator, or preferably on both stator and rotor. This excitation winding consumes only so many watts as are required for itself and the machine acts as a pure generator, transforming the total mechanical energy (less the losses) into mechanical energy. This was proven experimentally to be correct.



FIGS. 3, 4 AND 5.—DOUBLE-FIELD, ALTERNATING-CURRENT GENERATOR.

Moreover, it is not necessary to provide these special excitation windings, if the main windings are closed windings. As shown in Figs. 4 and 5, the excitation current is supplied at $c\ d\ e$ and $c^1\ d^1\ e^1$ (the former referring to the stator, the latter to the rotor in Fig. 5), while the main current is taken off from $f\ g\ h$ and $f_1\ g_1\ h_1$. If a machine arranged according to Figs. 3, 4, 5 is connected in parallel with a network of given voltage, it acts as a generator running above synchronism and is excitated from the network. The author gives some results of tests made with experimental machines. In summing up, he thinks that the generator will be mainly used for supplying currents of a given frequency to a network; the excitation requires polyphase currents of the same frequency and the speed must be either double the speed of the field or the number of poles must be twice that in ordinary generators. The relation of speed to number of poles is given as follows: For a frequency of 50 the speed is 6,000, 2,000, 1,000, 500 and the corresponding number of poles is 2, 6, 12, 24. With a frequency of 25 the speed is 3,000, 1,000, 500, and the corresponding number of poles, 2, 6, 12. The machine, would, therefore, appear to be especially useful for high speeds, like in turbo-generators.—*Elec. Zeit.*, July 6.

Single-Phase Motor With Large Torque.—ZWEIGBERGH.—An abstract of an English patent in which the inventor first refers to the impossibility of designing alternating-current motors of the induction type or with a commutator for a very large starting torque and then proceeds to explain an arrangement by which this may be achieved if two single-phase series motors (or a multiple of two) are available. Instead of two motors, one double-wound motor, with two commutators, answers the same purpose. If the first motor is called the "A" motor, its two field coils being denoted by a_1 and a_2, and if the second motor is called the "B" motor, its two field coils being b_1 and b_2, then he connects the four field coils and the two armatures to form a closed circuit, the order being a_1, A, a_2 b_2, B, b_1, the latter being also connected to a_1. In this circuit there is also a

small continuous-current generator. The alternating supply is connected at the junction of coils a_1 and b_1 and of coils a_2 and b_2. Supposing the single-phase current to enter at the junction of a_1 and b_1, it will flow through the two motors in parallel, leaving the closed circuit again at the point where a_2 and b_2 meet. Now it is apparent that the alternating current will be aided—at a particular moment—by the continuous current in one branch and opposed in the other branch. This means that the self-inductance is reduced in the one branch and increased in the other. In the former a large current is now able to flow, and a correspondingly large torque is exerted. In the next moment the alternating current has reversed, and the other motor gives a large torque.—*Lond. Elec.*, July 14.

Testing Alternators.—S. P. SMITH.—An article in which the author refers to different suggestions which have been made by Mordey, Ayrton and Behrend as to the best means of testing a single alternator in some way akin to the Hopkinson test for direct-current machines. The chief idea is to circulate full-load current through the machine without dissipating the full power. The author enumerates about a dozen possible modes of connecting up an alternator so that full-load current, at normal speed, may be caused to flow through its windings with a small expenditure of actual power. The methods of Mordey, Ayrton and Behrend appear as special cases of the general problem. Electrically, there is not very much to choose between the various kinds of connection, but for mechanical reasons a number of combinations have to be rejected. These methods are discussed by the author, who reaches the following general conclusions. For every ratio of generator to motor coils the respective fields should be symmetrically spaced all round the armature to avoid magnetic unbalancing and consequent mechanical disturbance. On account of armature reaction, it is in all cases desirable to use at least half the field coils as generator, obtaining a more equal distribution of flux round the armature, since the generator and motor lines per pole will more nearly equal one another, whilst the excess of resultant generator flux over resultant motor flux will be able to provide the necessary e.m.f. to drive the armature current. If it is decided to have unequal generator and motor-exciting currents, then the best combination is to divide up the field coils equally between the two and space the respective fields symmetrically round the armature. If it be decided to use equal field currents in motor and generator coils, then 60 or 70 per cent of the coils should be made to generate, whilst the rest should be equally interspaced to act as motor. The best combination can only be found in any particular case by trial—that is, when full-load current is obtained by normal field excitation. It is proposed to carry this method of testing alternators further, and to investigate more particularly how core losses and armature reaction are affected by thus dividing the field.—Lond. *Elec.*, July 14.

Electricity Meters.—GERHARDI.—A continuation of his illustrated serial. The author describes the Hookham and the Mordey-Fricker prepayment meters.—Lond. *Elec.*, July 14.

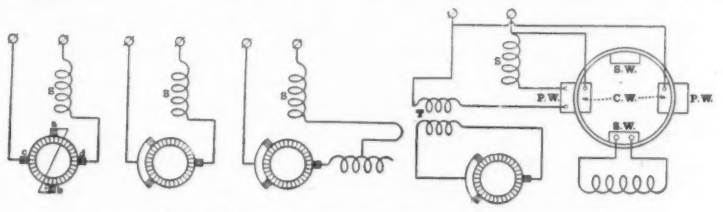
POWER.

Driving of Rolling Mills.—An illustrated article on two modern rolling mills electrically equipped by a German company. The installation at the Bethlen-Falva iron and steel works in Germany is first described. There are three electrically-driven rolling mills, and the Ilgner system is employed. Three-phase currents at 5,800 volts and 25 cycles per second are brought by the works from a power plant and are fed directly to a 600-hp induction motor, which is coupled to a 500-kw compound-wound, continuous-current dynamo, a cast-steel flywheel—weighing 18½ tons and having a peripheral speed of 260 ft. per second—being keyed to the shaft between motor and generator. The synchronous speed of the motor is 375 revs. per min. and the speed of the set varies between 300 and 365 revs. per min., according to the load. When the load on the motor-generator increases, resistance is automatically inserted into the rotor winding of the 600-hp induction motor. This increases its slip and lowers its speed, and thus affords the rapidly-rotating flywheel the opportunity of supplying part of the load. When the load drops, resistance is cut off of the rotor circuit; the rotor now speeds up, storing energy in the heavy flywheel. The continuous-current generator is connected to 500-volt bus bars, from which the three motors are supplied, which drive the roughing-down rolls, the intermediate rolls and the finishing rolls. Another installation in an Austrian plant is remarkable for the size of the motors employed. The mills are of the reversing type with one housing, and the rolls have a diameter of no less than 5 ft. 9 in. Blooms weighing 4,000 lbs. are delivered to the rolls and in 21 operations are converted into rails 100 ft. long and weighing 63 lb. per yard; also into beams 75 ft. long and weighing 190 lb. per yard. The rolls are driven without the intervention of any gearing by two motors, which are coupled together, having a combined normal rating of 3,600 hp and capable of developing for short periods anything up to a maximum of 9,000 hp. These motors run at a maximum speed of 110 revs. per min., and the speed control as well as the stopping and reversing is effected by a special 3,000-kw starting dynamo, designed to give a wide range of voltage by shunt regulation. This starting dynamo, together with a heavy cast-steel flywheel, is directly driven by a high-speed, three-phase motor.—Lond. *Elec.*, June 16.

Gas Engines.—MATHOT.—An article on methods for the starting of the gas engine, pointing out the simplicity and certainty of compressed air starting devices.—*Eng'ing Mag.*, July.

TRACTION.

Single-Phase Traction Motor.—An illustrated description of a single-phase traction motor, made by Bruce Peebles & Company, in Edinburgh. It is of the compensated repulsion motor type. Fig. 6



FIGS. 6, 7, 8 AND 9.—SINGLE-PHASE TRACTION MOTOR.

represents diagrammatically a bipolar, compensated, repulsion motor having four brushes at right angles. By short-circuiting the brushes *a* and *b*, the stator reactance is reduced owing to the armature ampere turns. A short-circuit current flows from *a* and *b* and back through the armature. This current reacts on the field flux in the direction *cd* produced by the main current, and a torque is produced. When the armature rotates, an e.m.f. is induced between *a* and *b* in its winding, due to the latter cutting through the field flux. This e.m.f. multiplied by the current, represents the motor output. The stator winding, *S*, though shown in the diagram as a single coil, is actually a distributed winding. In order to reduce the complication of brush gear and so on, the firm employs the modification shown in Fig. 7. Three brushes only are needed in the new arrangement, whose action otherwise is precisely the same as for the motor of Fig. 6. Fig. 8 shows another arrangement, which allows the motor speed to be varied within wide limits by strengthening or weakening the field flux. No series resistances are required at starting. The diagram, Fig. 9, shows a further development of the system, an induction regulator being used in this instance for the control of the field, while the stator winding is carried out on the high-tension principle; the transformer, *T*, allowing the commutator to be fed with current at a low voltage. The field winding is regulated by the position of the secondary winding, *SW*, of the induction regulator, and the compensating winding, *CW*, which is short-circuited, serves the purpose of annulling the self-induction in the primary of the regulator—so that only the ohmic losses in the same need be taken into account—and, further, of allowing additional speed regulation. It is claimed that in simplicity, lightness and efficiency the equipment is equal to any, while the power factor is believed to be higher than in any existing single-phase apparatus.—Lond. *Elec.*, July 14.

Motor Vehicles.—GARNUS.—The first of a serial of illustrated article on commercial motor vehicles. The present article deals with steam-motor vehicles.—*Cassier's Mag.*, July.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Financial Results of German Central Stations.—HOPPE.—There are invested in the 1,028 German central station at least $172,500,000. Concerning the financial results obtained in these stations exact figures are available only from about 10 per cent of all stations. These have been compiled and are discussed by the present author. All the figures refer to the year 1903. The first cost of installation is

given in the first column of table I, the stations being divided into seven different classes, according to their sizes.

TABLE I.

	Capital invested per kw. capacity.	Cost of operation per $1000 capital inv'sted
Over 5000 kw.	$345	$60.0
Between 2000 and 5000 kw.	365	65.0
" 1000 " 2000 "	340	72.0
" 500 " 1000 "	365 (385)	66.0
" 250 " 500 "	392.5 (417.5)	64.4
" 100 " 250 "	442.5 (450)	62.0
Below 100 kw.	610 (565)	56.5

In the four classes of smallest sizes some data as to the capital invested were available on gas-engine stations; the figures referring to these gas-engine driven stations are given in parenthesis. While the available data are somewhat scarce, it would seem that for stations above 100 kw, steam plants are somewhat cheaper in their first cost. The second column of the same table gives the cost of operation per thousand dollars of capital invested. It will be seen that the yearly cost of operation is in average 6 to 7 per cent of the capital invested. About one-third is expended for fuel, one-third for salaries and wages, and the last third for other expenses. This cost of operation covers only the direct expenses for running the plant and does not include any capital charges. About one-third of the cost of operation might be assumed as fixed charges.

TABLE II.

	Cost of oper't'n per 1-kw. capy.	per kw.-hour sold
Over 5000 kw.	$20.75	cents 2.5
Between 2000 and 5000 "	23.75	3.0
1000 " 2000 "	24.50	3.25
500 " 1000 "	24.25	3.5
250 " 500 "	25.25	3.75
100 " 250 "	27.50	4.00
Below 100 kw.	34.50	5.
Average	$25.80	

Table II shows again for the seven classes of stations, the cost of operation per 1-kw capacity and the cost of operation per kw-hour sold. In average 700 to 800 kw-hours have been sold per kw-capacity installed. In very many cities the direct cost of operation is considerably below 2.5 cent per kw-hour sold (the lowest figure is given for upper Silesia and is 1.12 cent per kw-hour sold). In many stations this cost of operation is, however, above 5 cents. It appears that in general in cities with large stations in operation for several years the cost of operation is lower than in newer and smaller stations. The author then compares this cost of operation with the total receipts and gives the difference in percentage of the capital invested. If the station is to work economically this difference must be high enough to pay interest for the capital and amortization. If the difference between the receipts and cost of operation is not more than 10 per cent of the capital invested, the station cannot be considered to be economical. This seems to be indeed the case for most of the stations discussed by the author, as shown in table III. This table gives first data arranged according

TABLE III.

	Lighting rate per kw.-hour.			Power rate per kw.-hour.			
	= 15 c.	above 15 c.	below 15 c.	above 5 c.	= 5 c.	less than 5 c.	Average "surplus" in percent of capital invested
Over 5000 kw.	—	12.0	8.6	6.7	10.1	—	10.5
Between 2000 and 5000 kw.	13.8	11.8	11.9	14.2	12.1	9.6	12.4
1000 2000	11.6	6.9	5.2	8.5	9.2	4.7	8.0
500 1000	8.0	9.1,	7.6	8.9	7.8	8.7	8.4
250 500	—	7.9	7.3	8.4	3.2	6.3	7.6
100 250	6.4	6.1	4.8	7.9	4.2	4.0	5.5
Below 100 kw.	—	4.4	3.8	3.1	4.2	—	3.9

to the rate charged for light and for power and finally the average surplus. The figures given are the difference of receipts and expenses in percents of capital invested. It will be seen that only the larger stations may be considered to be economical. Out of 83 stations there were only in 31 stations the difference between receipts and expenses more than 10 per cent of the capital invested, which is satisfactory; in 22 stations the result was very unsatisfactory, the difference mentioned being below 5 per cent of the capital invested; in the other 30 stations the difference was between 5 and 10 per cent. Of the 31 stations which work economically 20 were municipal and 11 owned by private companies. Of the 22 stations with very bad results seven were municipal and 15 were owned by private companies. The author emphasizes that it is absolutely wrong to charge for current for power purposes less than the net cost. He emphasizes that the capital invested should be as low as possible and that the construction should be simple and solid. The greatest economy in working is necessary. The conditions for making connections should be made as easy as possible and the meter rent should be as low as possible. Without exact calculations and investigation it is wrong to consider every consumer of current for power purposes a priori as a good acquisition. The general manager of an electric station should be at least as well versed in business affairs as in engineering.—*Elek. Zeit.*, July 20.

Works Accounts. From the annual report of the Manchester municipal electric station it appears that the new lamp connections during 12 months were equivalent to 52,080 lamps of 8 cp, and the new motor connections to 75,851 lamps of 8 c-p. Great progress has been made in the motor-hiring business, the motors on hire numbering 348 and totalling some 1,422 hp. It is stated that the percentage increase of power units for the year, amounting to no less than 74 per cent, must be directly attributable principally to the motor-hiring scheme. On the other hand, it is pointed out that the low rates charged for hire involve a certain amount of risk to the department, and very strict supervision, over the consumers as well as the motors, is required. The total kw-hours sold during the year were 33,686,710. The costs per kw-hour sold were as follows: Generating costs 1.000 cent, distribution costs 0.506 cent, total works costs 1.506 cents, management charges 0.432 cent, total costs excluding capital charges 1.938 cents, total costs including capital charges 3.696 cents. From the annual report of the Salford station it appears that 9,002,310 kw-hours were sold. The cost per kw-hour sold were as follows: Generating costs 0.754 cent, distributing costs 0.232 cent, total works cost 0.986 cent, management charges 0.378 cent, total costs excluding capital charges 1.364 cents, total costs including capital charges 3.130 cents.—Lond. *Elec.*, July 14.

WIRES, WIRING AND CONDUITS.

Cable Laying.—A communication from a German company arguing that for iron-sheathed cables, "freed" coal tar (a product obtained by dissolving coal tar pitch in anthracen oil) should always be employed. It is also thought that it should be employed for unarmored lead cables, since it offers greater security for the life of the cable than is possible where crude tar is used.—Lond. *Elec.*, June 23.

Zinc-Plated Iron.—SZIRMAY.—An account of experiments in which he tested the resistance against rusting of zinc-plated iron and steel wires, in order to compare the efficiency of hot plating with electro-plating. To test the resistance against atmospheric influence he placed his test wires under a globe into which air was introduced with sulphurous fumes and carbonic acid under pressure. He found that electroplated wires resist much better than any hot-plated wire, on account of the better adherence and the greater purity of the electrolytic deposit Similar results were obtained with other zinc-plated iron and steel ware, since the electroplated ware stands better bending and machining.—*Zeit. f. Elektrochemie*, June 2.

Rapid Electrodeposition of Copper.—COWPER-COLES.—A paper in which the author discusses the various processes for using a high current density in copper deposition. They are revolving or moving of the cathode, burnishing the copper during deposition, insulating the growths on the copper so as to prevent further increase, rapid circulation of the electrolyte, revolving mandrel at a critical speed. The last-named process is the author's own centrifugal process. The mandrels are suspended vertically and are provided with Pelton wheels, which are driven by the electrolyte impinging against them. In the most recent form, however, a tubular vat is used and hollow mandrels suspended on ball bearings, through the middle of which run the spindles. These are driven by a worm gearing from below. By using a mandrel in which a V groove has been indented the spiral deposit that results can easily be pulled away and then drawn down at once into wire, which can thus be made from crude copper in what is practically one operation.—From advanced sheets of a *Faraday Society Paper.*

Electric Steel Furnace.—An account of a recent demonstration in London of the Galbraith electric furnace. It is entirely of graphite, being built up of several units one on top of the other. Each unit is in shape of a box with top and bottom removed, and a number of graphite bars of rhombic section protrude through the box from front to back. In the furnace shown there were four bars in a horizontal plane, these bars being connected in front and back so as to constitute a grid. Altogether there are about eight such grids in the furnace ,one above the other, and the bars of any one grid are

staggered with respect to the bars of the grid immediately above and below. Low-voltage, alternating current is sent through the graphite bars in parallel, which thus become incandescent, their temperature rising to some 1,600 deg. C. Ironsand, just as it came from the huge deposits on the beach of New Plymouth (New Zealand), was heated in crucibles with powdered coal dust previously to the demonstration, and was then fed continuously into the furnace from the top. The following is an analysis of New Zealand ironsand: Peroxide of iron, 67.04; protoxide of iron, 30.17; manganese peroxide, 0.22; aluminium oxide, 0.16; silica, 0.50; calcium, trace; magnesium, trace; titanium, 1.60; undetermined, 0.31. This sand has always been considered to be practically free from phosphorus. The aim of the inventors is to produce steel directly and practically without a flux. The process is still in the experimental stage.—Lond. *Elec.*, July 21; Lond. *Eng'ing.*, July 21.

Heat Insulation.—HUTTON AND BEARD.—A Faraday Society paper on heat insulation, particularly with regard to materials used in electric furnace construction. He first describes a method for determining the absolute value of the heat conductivity of refractory materials. Tests of various substances show that light calcined magnesia and infusorial earth have the lowest heat conductivity. They are not suitable, however, directly as refractories since they shrink at the very high temperatures of the electric furnace. They can often be used, however, to advance in conjunction with some more stable though less good insulating material which serves for the internal lining of the furnace.—*Electrochem. and Met. Ind.*, August.

Action of Ammonia on Electrolyte of Storage Batteries.—VICAREY. An account of an investigation which shows that ammonia must be considered a dangerous impurity, the total absence of which, however, cannot be absolutely insisted upon. The presence of ammonia in the surroundings or neighborhood of the cell must be carefully guarded against, and the percentage actually present in the cell must be kept as low as possible by the use of water and acid of the purest quality. The effects of ammonia in its various combinations appear principally in two distinct forms: First, it causes an excessive disintegration or shedding of active material at the positive (PbO_2) plate; secondly, it becomes deposited upon the negative (spongy) plate, and finally closes up the pores of the active material, thereby causing a decrease in the ampere-hour capacity or efficiency varying from 10 to 60 per cent in about twelve months. The use of water taken from the steam boiler and termed "distilled" is mentioned as a dangerous practice that is common in central stations.—From advanced sheets of a *Faraday Society Paper.*

Electric Production of Nitric Acid.—CARVETH AND RAND.—A summary of the various processes which have been proposed for the production of nitric acid by passing electrical discharges through air. The following table gives results obtained by various experimenters, the figures giving the grams of nitric acid obtained per kw-hour:

1897 Rayleigh	49.1	grams	HNO_3
1900 McDougal and Howles (best yield)	33.8	"	"
1902 De Kowalski	55.0	"	"
1903 Muthmann and Hofer	70.0	"	"
1897 Crookes	74.0	"	"
1902 Bradley and Lovejoy	83.0	"	"
1904 Birkeland and Eyde	110.0	"	"

The calculations of Muthmann and Hofer indicate 157.5 grams of nitric acid per kw-hour as the theoretical maximum efficiency.—*Sibley Jour. of Eng'ing*, May.

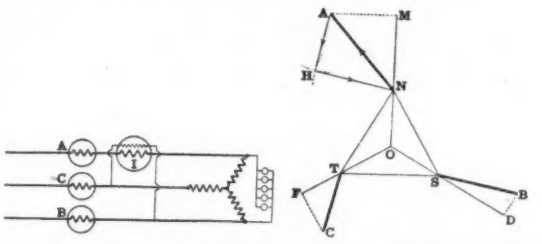
Electric Endosmosis.—REIFF.—An article giving a summary of the investigations of Wiedemann on endosmosis or cataphoresis, which is the phenomenon of the bodily transfer of the liquid through a porous diaphragm during the passage of a current, which phenomenon is distinctly different from the migration of the ions. Cruse has recently determined the influence of temperature of endosmosis and found that the electric endosmosis of distilled water through a porous diaphragm of clay increases with increasing temperature to a maximum which is reached at 35 or 40 deg. C.; afterward the endosmosis decreases. Schwerin has tried to utilize this phenomenon for separating water from peat.—*Elec. u. Polyt. Rund.*, July 1.

Osmotic Experiments.—BARLOW.—An account of osmotic experiments on mixtures of alcohol and water. The author has repeated with great care the experiment of Pickering which the latter considered as a crucial one against the dissociation theory and in favor of the hydrate theory. The present author shows that this conclusion is thoroughly unwarranted. Nevertheless, he agrees that some kind of hydrate theory seems necessary, but in this sense it must not be regarded as excluding dissociation.—*Phil. Mag.*, July.

Voltage Series.—DANNEEL.—An account of experiments which appear to show that, while at ordinary temperatures calcium is more negative than sodium, their relative position in the voltage series is reversed at higher temperatures.—*Zeit. f. Elektrochem.*, April 7.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Three-Phase Power Measurement Without Wattmeters.—A communication first referring to the case that the load consists of induction motors only. The load is then balanced and a single ammeter in any one of the three conductors, together with a single-phase indicating device, enables the calculation of the total three-phase power. If the load consists partly of induction motors and partly of incandescent lamps, the load will in general no longer be balanced. In this case it is possible to find the total power with the aid of three ammeters in each of the three phases and a single wattless-current ammeter, arranged as shown in Fig. 10. In the vector



FIGS. 10 AND 11.—THREE-PHASE POWER MEASUREMENTS.

diagram (Fig. 11) draw the equilateral triangle $N\,S\,T$ to represent the three pressures between terminals, the length of the side being supposed proportional to the voltage E. From the center O draw the three equivalent star vectors through the points N, S and T, respectively. Now, from the readings I and A of the wattless-current ammeter and the ammeter in series with same calculate the energy component of the current by means of the formula $M\,N = \sqrt{A^2 - I^2}$. This gives the point M on the prolongation of the vector $O\,N$, and by completing the right-angled triangle $N\,M\,A$, with the length $M\,A$ to represent the wattless current, the direction of the vector $N\,A$ is obtained, which represents the current in the ammeter A (Fig. 10). The two other current vectors $S\,B$ and $T\,C$ are now easily drawn because the vectorial sum of all three currents must necessarily be equal to zero. From the point N as a center describe an arc of circle of such a radius as to represent the current indicated by the ammeter B, and from A as a center describe another arc of radius $A\,H$ equal to the current C. These circles will intersect at the point H, and the triangle $N\,A\,H$ will, therefore, represent the closed polygon of the current vectors. Draw $T\,C$ equal and parallel to $A\,H$ and $S\,B$ equal and parallel to $H\,N$; also drop the perpendiculars $C\,F$ and $B\,D$, respectively, on the prolongations of the pressure vectors $O\,T$ and $O\,S$. The diagram is now complete and the total power is given by the expression: Watts $= \sqrt{3}\,E\,(N\,M + T\,F + S\,D)$.—Lond. *Elec.*, July 21.

Alternating-Current Meter.—An official statement from the *Reichsanstalt* concerning admission for calibration of the "Isaria meter" for single-phase current made by the Luxsche Industriewerke. It consists of a magnetically braked induction motor and a counting device. The motor consists of the light revolving disc A_S of alumini-

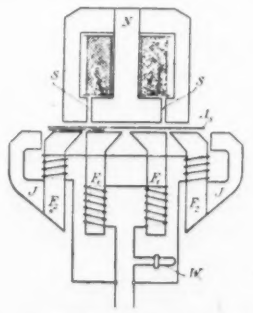


FIG. 12.—ALTERNATING-CURRENT METER.

um in Fig. 12, the shunt magnet N above the disc, while below the same four main-current magnets F_1, F_1, F_2, F_2, are provided. The iron core of the shunt magnet N is almost completely closed, so that

there is strong self-induction, on account of which the shunt current lags, $a = 70°$, behind the voltage at the terminals. The slits $S\,S$ produce stray fields which cut the aluminium disc. This is the shunt field H_1, which is proportional to the supply voltage, but lags in phase behind it by 70°. The main current when entering the meter divides itself into two branches, of which the first passes around the cores $F_1\,F_1$; this circuit contains essentially non-inductive resistance on account of the wide air space between the cores and the non-inductive resistance W. The second branch is around the cores $F_2\,F_2$ and contains a high self-induction on account of the attached parts J. The main current, therefore, consists of two components, of which the one passing through $F_2\,F_2$ lags in phase behind the other, which passes through $F_1\,F_1$. The direction of the windings in F_1 is opposite to that in F_2. The total main field H_2 produced by both together leads in phase before the main current; the self-inductions and resistances are so chosen that the angle of lead is 20°. Now, if H_1 and H_2 are the shunt field and the main field, respectively, the torque exerted on the disc is proportional to the product of H_1 and H_2 and to the sine of the phase difference between the two. This phase difference is 90° minus the phase difference between supply voltage and current; H_1 is proportional to the supply voltage and H_2 to the main current; hence the torque is proportional to the power. The disc revolves between the poles of a magnet, and the braking effect is proportional to the instantaneous speed, so that the number of revolutions which are counted by the registering device is approximately proportional to the power. The construction of the meter and the method of calibrating are described in great detail. A three-phase meter, based on the same principles, is also described.—*Elek. Zeit.*, June 29.

Measuring Efficiency of Dynamos.—BOEHM-RAFFAY.—A description of Swinburne's method of determining the efficiency of a dynamo from its separate losses, when an auxiliary source of electricity of lower voltage than the normal voltage of the tested dynamo is available.—*Elek. Neu. Anz.*, June 15.

Cable Steamer.—An illustrated description of the twin-screw cable steamer *Cambria*, which, though not one of the largest, is said to embody all the qualities of an ideal telegraph steamer.—Lond. *Elec.*, June 16.

Central Battery System.—MUELLER.—The first part of an illustrated article on the use of the central battery system in Austrian telephone exchanges.—*Zeit. f. Elek.* (Vienna), July 9.

Management of Industrial Organizations.—WILLIAM H. NICHOLS. His presidential address before the Society of Chemical Industry. He deals in great detail with the management of a large chemical industrial organization and discusses the duties of the different departments. He especially deals with the operating department, the construction department, the investigation or research department and the statistical department. The latter he considers absolutely essential for a company owning several works. The statistical department has to do with the combination of facts and the deduction from them. This department of his own company is not only able to advise the officers within a reasonable time after the end of each month of the cost of every product and step, but also of the profit or loss on each article and the total profit or loss of the company. These results have been so exact that for several years the profits determined by public accountants at the end of the year have not varied 1 per cent from those compiled by the statistical department month by month.—*Jour. of the Soc. of Chem. Ind.*, July 15.

Biographical.—A biographical sketch, with portrait of Alexander Jay Wurts, with reference to his recent appointment to the faculty of the Carnegie Technical Schools.—*Elec. Jour.*, July.

BOOK REVIEWS.

MOODY'S MANUAL OF RAILROADS AND CORPORATION STATISTICS. 1905. New York: Moody Publishing Company. 2,580 pages. Cloth, $10.

This interesting and valuable manual covers literally the entire field of corporation investment, and the effort to add to its utility is manifested in the addition of 80 per cent of contents over the matter furnished last year. A good deal of the new data belongs to the electrical field, which is doing its share in providing new opportunities for shrewd and careful investors. While there are other sources of reference for railroads and lighting companies, this is in point of fact the only one for allied industrials and for telegraph and telephone companies. An excellent feature also is the inclusion of membership lists for the 25 stock exchanges of the United States. As our readers are probably aware, not only are the financial data furnished as to any given corporation, but the names of its officers and directors and other details in regard to which there is constant inquiry. The full indexes make all the material handy for swift reference and study. The Manual is, indeed, a birdseye view of the vast development and condition of corporate investment industry and personnel in the United States.

ENTWURF UND KONSTRUKTION. By Ernst Schulz. Hannover: Gebruder Janecke. 132 pages, 110 illustrations.

This little work of 132 pages, containing 110 cuts, is a very interesting study for a designing engineer. It presupposes not only a fair knowledge of the methods of designing direct and alternating-current motors, but a familiarity with the subject. The author points out that competition forces manufacturers and more particularly the smaller ones, to use the material more economically and ventilation more freely than formerly. He goes further in many respects than many makers would, by suggesting and using the same frames for polyphase motors as for direct-current motors. By so doing the cost of manufacture is lowered as the same patterns, gauges, bearings and end plates for both types of motors would be identical. He illustrates his assumptions on examples which are well carried out in detail.

He makes use of and refers to the very latest publications of Profs. Arnold, Niethammer, Sengel, Mr. Hobart, Fischer-Hinnen and others, comparing their formulæ in a very interesting and instructive way, although the engineer who does not possess these other works will have trouble in more than one place to follow the author, as the measuring of some of the letters of these other authors is not to be found in the key given at the beginning of the book.

It is divided into two parts. Part I treats on direct-current motors. In Chapter I the proper selection of armature diameter to length parallel to the shaft is considered. He shows Prof. Arnold's curve which was published in the *Elektrotechnische Zeitschrift* in 1903 and appears also in his masterly works recently published. In a table the author compares diameter and length of armatures of from 3 to 150 hp as found from the Arnold formula and that of Sengel. The dimensions derived by means of the former formula lead to a more economical design all the way through. The chapter closes with a discussion on length and width of field magnet coils. Chapter II deals with the selection of the number of poles; Chapter III judging the quality of a machine by means of modern theory. In this chapter he discusses Hobart's article on the commutation of dynamos, which appeared in the *Elektrotechnische Zeitschrift*, 1901, and especially the reactance determination; also the methods of Rothert, Niethammer and Fischer-Hinnen, pointing out their differences and discrepancies.

Chapter IV deals with the shapes of pole shoes and their materials, while Chapter V discusses yokes, forms and material. The design of machines for production in quantities is treated in Chapter VI, and in VII examples are enumerated and arranged in form of tables of types which can be built with the same punchings; they having the same diameter, slot number and shape, while the axial core length is varied. The pressures selected are 110, 220 and 440 volts, the speeds vary from 1,200 to 300 r.p.m., and the capacities from ¾ hp to 5 hp.

Throughout his determinations the author uses the formulæ of several well-known engineers, such as Arnold's and Fischer-Hinnen, and points out the differences in the results, which is very instructive. The first part closes with the determination of the cost price of a line of machines so designed.

The second part which follows, treated on similar lines, is very interesting. Chapter IX deals with the selection of diameter and core length of the rotor of a polyphase motor. Also here the curve of Prof. Arnold is used and its suitability pointed out. Although heretofore larger dimensions were used, makers more and more use smaller dimensions and better ventilation.

In determining the leakage coefficient σ he shows that Behrend's so-called constant is not a constant, and that the table of Hobart's article for the determination of leakage lines published in the *Elektrotechnische Zeitschrift* in 1903, pages 933 and 934, is of greater importance than the curves given in the article because the latter can lead to entirely wrong values if not used with a great deal of discrimination.

The author is correct in his arguments that the slot opening of the punching is no criterion, and that it is of vital importance to compare this slot opening with the length of the air-gap. Authorities such as Arnold and Benischke hold similar views as the treatment of this subject in their recent contribution to the technical literature indicates. An example is given to illustrate this point.

Chapter X treats the subject of the slot number of stator with regard to manufacture in quantity. In the determination of suitability of slots the author is guided by the greatest number of times a given punching can be used for either a single, two or three-phase motor of 4, 6, 8, 10, 12, etc., poles.

In Chapter XI the details and determinations of a 4, 5 and 6-hp, three-phase motor are given which are well carried out, although the relative selection of 48 stator slots and 36 in the rotor is not considered the best practice.

The subject is followed by a short description and illustrations of modern direct and polyphase motors of well-known European makers of capacities below 10 hp. The author shows by means of these illustrations that the dimensions of polyphase motors are approaching those of direct-current motors, and that the task of simplifying the manufacture by utilizing as much as possible the same parts for direct current as well as polyphase machines can be accomplished.

Power Factor in Induction Motors.

BY A. A. AVERRETT.

The question whether three-phase or two-phase induction motors have the higher power factor, other features being equal, has often been discussed. The following considerations show that a three-phase motor always has the advantage of a higher power factor than a two-phase motor having an equally good arrangement of copper and the same maximum output and efficiency.

Three-phase and two-phase motors are actually wound six-phase and four-phase (60 deg. and 90 deg. windings), respectively. The operating conditions for induction motors are somewhat similar to those for six-phase and four-phase rotary converters, in which the six-phase winding gives better results than the four-phase winding.

The reason for the superiority of the three-phase, 60-deg. winding lies in the fact that the ratio of effective turns to actual turns is as the chord to the arc. This ratio is $\frac{3}{\pi}$ in 60 deg. windings, while in two-phase (90 deg.) windings the ratio is $\frac{2\sqrt{2}}{\pi}$. In other words, the 60 deg. winding has 95.6 per cent of the actual turns effective, while the 90 deg. winding has only 90 per cent of the turns effective. Fig. 1 graphically presents this advantage of the three-phase over the two-phase winding, by showing how the length of the chord approaches the length of the arc more nearly in the chord which subtends an angle of 60 deg. than in the chord which subtends an angle of 90 deg.

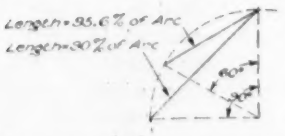


FIG. 1.—DIAGRAM SHOWING THE RATIO OF EFFECTIVE TURNS TO ACTUAL TURNS FOR TWO-PHASE AND THREE PHASE.

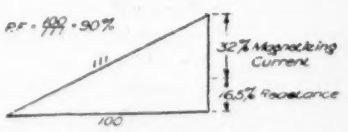


FIG. 2.—METHOD OF FINDING POWER FACTOR.

A representative General Electric three-phase motor having a power factor of .90 at full load and .83 at half load will have about .32 magnetizing current, .165 reactance, and a stationary impedance current of about 5.75 times full load current. The same motor if wound two-phase will have .36 magnetizing current and the same reactance (.165) at full load, which will give a power factor of .89; while the half load power factor will be .80.

The following table gives the values of power factor at full load and half load, and of per cent magnetizing current and per cent reactance at full load, for "moderate-speed" and "slow-speed" three-phase and two-phase motors. In computing these results, the energy losses, which would affect the results but slightly, have been neglected. The power factor at full load may be found by the approximate graphical method shown in the example, Fig. 2, knowing the per cent magnetizing current and per cent reactance.

Type of Motor.		% Power Factor.	% Mag. Current.	% Reactance.
3-Phase Mod. Speed	Full Load.....	90	32	16.5
	Half Load.....	83		
2-Phase Mod. Speed	Full Load.....	89	36	16.5
	Half Load.....	80		
3-Phase Slow Speed	Full Load.....	84	45	20
	Half Load.....	69		
2-Phase Slow Speed	Full Load.....	82	50.5	20
	Half Load.....	65		

While these results are approximate, the same degree of approximation is obtained in each case, so that a comparison of the results gives a fair idea of the relative values of the two types of motor. The power factors and magnetizing currents in the above table show the superiority of the three-phase 60-deg. winding over the two-phase 90-deg. winding. It will be noted that the advantage of the three-phase over the two-phase winding is somewhat greater in the slow-speed than in the moderate-speed motor.

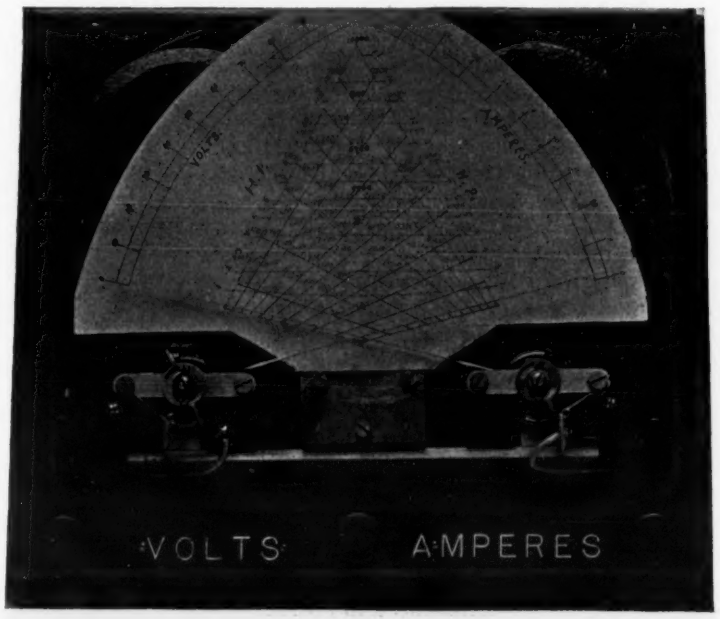
The above considerations show that two-phase motors have inherently a lower factor than three-phase motors. The data fairly represent good modern induction motors. It is possible to make as favorable a power factor showing for the two-phase as for the three-phase winding by the use of an excessive amount of material and at the expense of efficiency.

A New Electrical Measuring Instrument.

BY W. P. SNYDER AND H. HERZBERG.

In the accompanying illustration is indicated the general construction of a type of instrument which serves simultaneously for measuring the amperes, volts, watts and horse-power in an electrical circuit. The instrument consists of a voltmeter and an ammeter so housed in the casing that the individual pointers while moving along their respective scales must always cross each other. The points of intersection of the pointers are graduated from the product of the readings indicated on the voltmeter and ammeter scales, so that each point corresponds to a certain definite value of watts.

By joining these points at various positions over the scale which corresponds to 746 watts, there is obtained a line every point of



HORSE-POWER METER.

which corresponds to one horse-power. Similar lines are drawn for various values of watts corresponding to any desired values of horse-power, so that the instrument is graduated to read it in horse-power as well as in watts. The location of the horse-power lines will be noted from an inspection of the accompanying illustration.

It is interesting to note that, while each horizontal line corresponds to a definite value of power, and each vertical line which is inclined to the right corresponds to a definite value of current, and

that each vertical line which is inclined to the left corresponds to a definite value of e.m.f., each point on the surface of the chart corresponds simultaneously to a certain value of volts, of amperes, of watts and of horse-power.

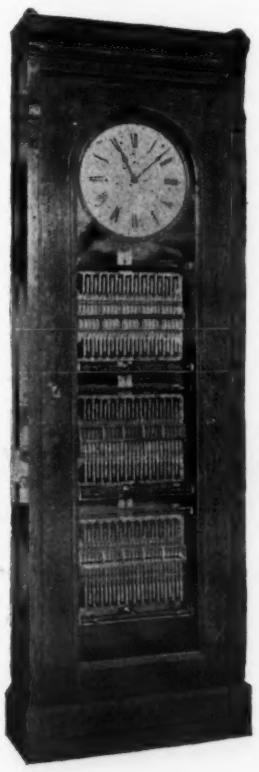
The instrument is intended for use on direct-current circuits. It contains the complete actuating parts of both an ammeter and a voltmeter, but the two being combined in one case it is considerably more compact and convenient than would be true of two separate meters, while the power meter features are obtained without additional equipment or complications. It is evident that the instrument is advantageous for use in any direct-current installation. It possesses special advantages, however, for the electric automobile with which a power meter has not heretofore been used on account of the added complication and expense, the voltmeter and ammeter being required in any event. As a portable instrument for testing purposes the new meter should prove of great value to the electrician.

This instrument which is called a horse-power meter by its inventors, W. P. Snyder and H. Hertzberg, is now being exhibited by Griffin & Bernhard, 277 Broadway, New York.

Large Electric Magneto Watchman's Clock for Boston.

A 150-station electric magneto watchman's clock, probably the largest in the world, has recently been built for Messrs. Jordan, Marsh & Co., of Boston, by the E. Howard Clock Co., of that city. As shown in the illustration, the recording magnets are banked in three vertical sections of 50 pairs each, dividing the clock as far as recording purposes are concerned into three separate clocks of similar design. The clock is 8 ft. 6 in. high, 33 in. wide and 14 in. deep over all dimensions, and the mechanism is installed in a handsome solid oak case with hinged door and plate glass front. It is guaranteed to keep within 30 seconds per month of correct time and is driven by weights with pendulum and jeweled escapement. The weight of the clock complete is 250 lbs.

Above each of the three double banks of magnets is a spool upon which the recording strip of paper, 15 in. wide, is placed, the capacity



MAGNETO WATCHMAN'S CLOCK.

of each spool being sufficient for a week's run. The paper passes from the reel through a guide rod to the perforating bar in the centre of each group of 50 magnets, whence it goes to two milled wheels mounted on a horizontal shaft that is bevel-geared to the mechanism of the time clock above. The movement of the clock draws the paper downward, and it then passes over a knife edge below the magnet group which perforates it, dropping in a long roll into the bottom of the case unless it is torn off by hand as it traverses the knife edge.

The magnets are fitted with armatures to which small brass levers are attached, the fulcrums of the levers being located for each set of magnets in the horizontal supporting bar nearest the latter. One of these supporting bars or light trusses is located on each side of the perforating bar, the arrangement being the same in all three sections of the recording mechanism. The armature or striking levers each carry a needle point at the end which perforates the paper as the watchman at any particular station rings in his visit. The magnets are operated without batteries, the current being forced through them by the alternating e.m.f. generators in the magnets at the station boxes. Each box is connected by a single wire with its corresponding magnet pair, a common return wire being used for all the stations. The resistance of each coil is about 20 ohms, two coils of No. 26 B. and S. silk-covered wire being used on each electromagnet. All wires which pass over metal work are encased in rubber tubing to prevent abrasion and resulting short circuits or breaks. Lever springs are used on the backs of the armature connecting bars to hold the needles away from the paper when there is no current in the electromagnets.

An important advantage of the clock lies in the facility with which the records can be read, in comparison with the usual circular dials. Ordinarily, also, paper rolls have to be replaced every 12 hours. The continuous record of the new Howard clock, extending over a week's time, enables records to be made at any hour of the day and night and does away with interruptions in business hours, as well as the expense and inconvenience of Sunday and holiday replacements by a specially named employe. Clocks of this description are now made in various sizes with the foregoing as a maximum, the prices of complete installation varying from about $500 to $1,500. A 30-station clock of this type has recently been placed in service in the new Post Office Square Building, Boston.

New Type of Direct-Current Power-Circuit Lamp.

The General Electric Company has recently placed on the market a direct-current power-circuit arc lamp similar in design to the parallel-rod edgewise-wound multiple lamp. This new lamp, which is shown in the accompanying illustrations, embodies all of the advantages of the parallel-rod design and at the same time has distinctive features which are considered to make it more desirable than the usual differential power circuit type of lamp.

The new lamps are designed for use two in series on 220 volts or

FIG. 1.—EDGEWISE-WOUND LAMP.

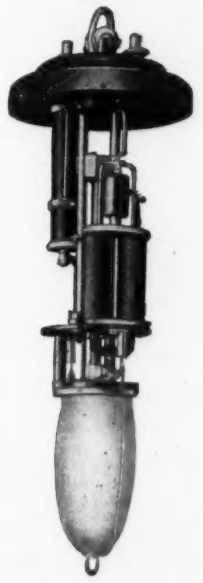


FIG. 2.—VIEW OF LAMP WITH COVER REMOVED.

five in series on 550 volts, and they can also be operated singly on 110 volts by removing the regulating weight that forms part of the mechanism of each lamp. This type of lamp is recommended for use on 220 volts, where permissible, in preference to the 220-volt multiple lamp, on account of its higher efficiency and better quality of light.

The parallel rod construction for arc lamps has been well known for some time, and many thousand lamps of this design are in successful operation. The lamp has obtained its name from the fact that the two main castings, top and base, are connected by two parallel steel rods. The magnets are mounted upon the base of the lamp, and the adjusting resistance is supported between the top and the base. The magnets and resistances are all parallel to the main connecting rods, an arrangement which presents a most attractive appearance. All who have had experience with the multiple lamp will recall the novel construction of the coils for the magnets and resistances. These coils are produced by winding ribbon wire on edge, and insulating the consecutive turns with non-combustible material. This construction, which has been followed in the new power-circuit lamp, is practically indestructible.

In the design of the new lamp, the number of insulating and other parts has been reduced to a minimum. All necessary insulating pieces have been so designed as to insure mechanical strength as well as good insulating qualities. Particular attention has been paid to the insulation of the frame from the current-carrying parts. The insulating pieces are of porcelain, the number of small bushings and mica washers having been reduced to a minimum. The absence of lead wires is very noticeable, there being in the lamp only one flexible cable (insulated with glass beads). With this construction, the insulation of the lamp is nearly ideal.

To adapt the parallel-rod lamp to operation in series on power circuits, an improved mechanical device has been designed to maintain the proper voltage relation among the various lamps of the series. Suspended from a lug in the lamp top, and projecting downward, is a bell-crank lever having one arm weighted and the other attached through a connecting link to the top of a frame that is carried by the magnet armature. The distance of the weight from the fulcrum of the lever is adjustable. The object of this weight is

FIG. 3.—VIEW OF LAMP WITH EXTERNAL CUT-OUT.

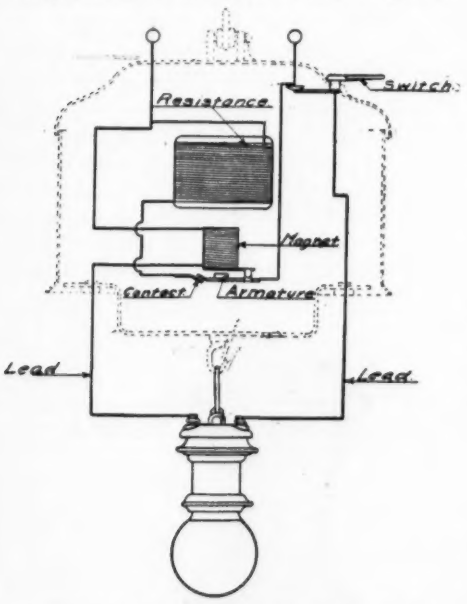


FIG. 4.—CONNECTIONS OF AUTOMATIC CUT-OUT AND RESISTANCE.

to counteract any tendency toward unequal arc lengths among the lamps caused by so-called "stealing of voltage." By this simple mechanical device, the regulation of the lamp is obtained without the employment of shunt magnets.

The only resistance used with the new power-circuit lamp is an adjusting resistance, the cut-out resistance, which is so common with other lamps of this type, having been omitted. While the failure of any lamp of a series unprovided with cut-outs will cause the entire series to go out, such failure is extremely unlikely with the new power-circuit lamps, as the simple construction of the lamp renders it thoroughly reliable. However, an individual cut-out is furnished when desired. The cut-out, which is an entirely separate device from the lamp itself, is connected in series with the lamp and hung directly over it, as shown in Fig. 3. In operation, a small controlling magnet, in series with the lamp, releases its armature when the lamp goes out, thereby placing the cut-out resistance in circuit.

The arrangement and connection of this cut-out is shown in the accompanying diagram, Fig. 4. The device constitutes a very compact form of resistance, which can readily be substituted for the lamp if required. The simplicity of the construction of the parallel-rod lamp insures a low maintenance cost.

Automatic Self-Adjusting Clutch.

A clutch that grips automatically with the load and cannot slip when fully engaged; that is self-adjusting until worn out; that will accelerate a load from rest to full speed uniformly under absolute control entering a locked or positive engagement—such a clutch is a desirable piece of mechanism and is said by the American Automatic Clutch Company, of Akron, Ohio, to be represented in their device herewith illustrated in Figs. 1 and 2.

In Fig. 1 a sectional view of the automatic clutch is shown in the disengaged or off position. *A* is the operating sleeve which carries the pins, *B* and *C*, shown in section, which fit between the faces of the cavity in the keyed member, *D*. Loosely placed between the pins *B* and *C* is a lever, *E*, which extends between the ends of the expansion ring, *F*, which is surrounded by the cup or loose member, *G*.

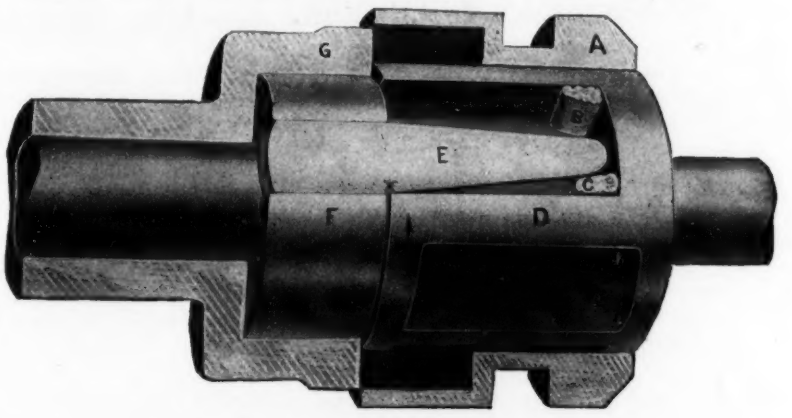


FIG. 1.—SECTIONAL VIEW OF CLUTCH.

Now if the keyed member, *D*, be rotating in the direction indicated by the arrow, the ring is freely revolved by the lever, *E*, which is driven at point *x*, as pin *C* is free of the lever; and pin *B* operates on the lever only when the member *D* is revolving in the opposite direction.

When the clutch is engaged the sleeve *A* is moved to the left and pin *C* gradually relieves the bearing point, *x*, on the lever, and the member *D* drives the ring by the lever through the pin *C*. This causes the lever *E* to expand the ring *F* within the cup *G*, with such pressure that the friction caused exceeds the force on the lever, so that the greater the load the tighter the grip.

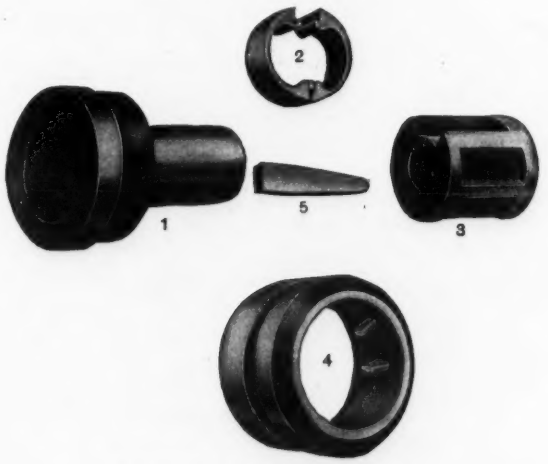


FIG. 2.—ELEMENTS OF CLUTCH.

This small and compact clutch is simple also, consisting in all of five parts, and contains no toggles, links, bolts, etc. These five parts are shown in Fig. 2 separately, 1 being the loose member or cup forming the hub, 2 the self-adjusting expansion ring, 3 the tight member which is keyed to the shaft, 4 the operating sleeve, and 5 the expanding key or lever.

GENERAL VIEW OF ILLUMINATION AT PORTLAND EXPOSITION.

Electrical Exhibits at the Portland Exposition.

Reference has been made in previous articles in these pages to the electrical features of the Portland, Ore., Exposition. We are now able to give below some general notes on the leading electrical exhibits:

The exhibit of the Northern Electric Manufacturing Company, of Madison, Wis., in the Machinery, Electricity and Transportation Building at the Lewis and Clark Exposition, Portland, covers some 800 sq. ft. of display space situated near the main entrance to the building. A special feature in connection with this exhibit and one which attracts attention is the number of motors and motor-driven machines in actual operation. Diametrically opposite and facing the main entrance to the building is a pedestal tool-grinding machine operated by a Northern Electric 220-volt, 20-amp., direct-current motor. A 35-hp elevator, direct-current motor and a vertical type 2-hp motor on a stand near by are seen immediately adjoining one of the main aisles of the hall. A pedestal polishing machine, obtaining power from a 220-volt, 2-hp motor, running at 3,000 r.p.m., is in another section near by, while the center of the display contains a 125-volt gasoline engine, direct-connected to a 125-volt, 48-amp., direct-connected generator with a 48-in. ventilator fan running at 500 r.p.m. and direct-connected to a 220-volt, 25-hp direct-connected motor. A 2-hp motor direct connected to a triplex pump with a motor-generator set and several types of small motors completes a display of machinery which is all, with the exception of the elevator motor, seen in actual motion, a fact which adds immensely to the effective exploitation of the uses of electricity.

The American Bell Telephone Company's exhibit in the Machinery, Electricity and Transportation Building, besides being of general interest as a display of the company's system of telephone service throughout the continent, is utilized in part, at least, for actual service in the grounds. In the operating room of the pavilion built by this company for the Exposition, is a switchboard with a capacity of 500 lines, some 135 or so being in use at the present writing and requiring the services of three operators for the day and one for the night work. Adjoining the switchboard are the batteries, main and intermediate frames, charging and ringing machines, etc., showing the complete mechanism for operating a modern telephone system. To the left of the operating room, in a separate apartment, is the Bell automatic telephone, limited to 100 switches, together with switchboards for the same and some types of their private exchange boards. A reception booth comfortably furnished with carpets, tables and easy chairs, and having a private telephone room, is located on the other side of the operating room and is open during the day for the use of visitors. Telephones are installed in the Fair Grounds at regular city rates and long-distance service can be obtained at the pavilion when desired.

Among the attractive displays in the Machinery, Electricity and Transportation Building, that of the Western Electric Company, of Chicago, is particularly noticeable. It occupies a display space of some 2,400 sq. ft., every available portion of which is utilized by exhibits typifying the various products of the company. Situated in the center of the exhibit is a 500-kw, single-phase, revolving field, engine type Western Electric generator, while on a pyramidal frame adjoining are shown the different types of motors manufactured by the company, and ranging in size from a 1/12 horse-power to a 50-horse-power. Opposite the motors is a section devoted to the display of arc lamps from 3/8-in. carbon to the series alternating lamps in operation, suspended from iron trees, and capable of being lowered for closer examination when desired. This section includes, among others, five series multiple, 500-volt lamps, 220-volt, 2-in. series multiple lamps, and 110-volt multiple alternating and direct-current lamps. Encircling the entire display space of the Western Electric Company and hung about 8 or 9 ft. from the floor, are 50 alternating enclosed arc lamps, with transformers and regulators, making an exceptionally fine showing. In another section near by, arranged on display board and stands are the various supplies handled by the company, among which may be mentioned Bryant and Perkins' goods, Thomas high-potential porcelain insulators, Electrose overhead railway material, D. & W. enclosed fuses as well as ventilator exhaust, desk and ceiling fans, several of which are in operation. A Rateau steam turbine direct-connected to a 15-kw Western Electric 220-volt, direct-connected generator is soon to be added to the display and will, no doubt, prove a valuable adjunct to this already interesting and instructive exhibition.

The Fairbanks-Morse Company, of New York City, N. Y., have a very large exhibit in the southern portion of the Machinery Building, and covering in the neighborhood of 5,200 sq. ft. of floor space, every available portion of which is utilized to display the heterogeneous variety of machinery manufactured by the factories of the company. Opposite, and to the right of the main entrance to their exhibit, the management have installed a 50-hp multiple cylinder, vertical type gas engine belted to a dynamo on the same base, which proves a most efficient factor for supplying the illumination of the electric sign clusters, and lights for their display. Near this unit are the vertical and horizontal types of the Fairbanks-Morse Co.'s gas, gasoline, kerosene and crude oil engines, the 2 and 4-cycle marine engine operated by gasoline or kerosene, also combined gasoline engine and air compressor, combined gasoline engine and hoist, combined gasoline engine and dynamos. Next to the gas engines are the motor-driven duplex pumps and duplex steam pumps, also farm engines for grinding and pumping. The display of their railway department was very thorough in every detail comprising gasoline motor cars, push cars, railroad jacks and general track tools and a 100-ton railroad scale with printing beam. The display of scales made by the company comprised everything from a grocery to the above-mentioned 100-ton railroad scale. A unique feature in con-

nection with their scale display is the fancy scale situated at the main entrance to their exhibit attended by a weight boy handing visitors their weights printed on a neat ticket. Across the aisle is the mining department exhibit, showing in motion the Nissen 2-stamp battery for quartz and their Elspass 4-roller quartz mill and an automatic ore dump. Outside the building at the main entrance to the exhibit are shown the windmills and irrigation goods, and on the Trail a Fairbanks-Morse Company's horizontal engine running on kerosene and belted to a centrifugal pump raising 2,000 gal. per minute against a 26-ft. head completes a display of machinery of which the company's management may feel justly proud.

The General Electric Company's exhibit covers 6,000 sq. ft. of space in the Machinery, Electricity and Transportation Building, this being the largest space assigned to any exhibitor in the grounds. The display comprises a multifarious collection of machinery covering the various classes of electrical apparatus manufactured by the company. In the center of the exhibit is a colonial office and reception booth comfortably and tastefully furnished and carpeted, while radiating from it are several aisles passing through different sections of the exhibits and leading to the various exits and entrances to same.

Near one of the many entrances is a 60,000-volt oil switch in operation, also a 4-motor equipment of the General Electric 67-hp motors mounted on Brill trucks with controllers, this equipment being identical with that supplied to the Washington Water Power Company, of Seattle, Wash. The power machinery comprises new types of single and three-phase alternating current motors and types of direct-current motors, as well as a Curtis direct-current turbo-generator set. Those especially interested are given the privilege of inspecting the new power house of the Portland General Electric Company, in which has lately been installed two 1,500-kw, three-phase Curtis turbo-generators, which supply all the current used for illuminating and operating the Exposition. The display of street railway appliances is very thorough in every detail, comprising all classes of line and track specialties as well as high capacity street railway switchboard equipments. In the southern portion of the exhibit and near one of the side entrances, is an 8-ton electric mining locomotive with special cable reel, operated by either reel or trolley, on a 30-ft. track. Exhibits of wire, cable sockets, fuses, lightning arresters and porcelain specialties occupy another section, and near by is a complete line of indicating and recording instruments mounted on display boards where the operating parts may be readily inspected. A 30-amp. mercury arc rectifier changing 220-volt, 60-cycle alternating-current into 110-volt, direct current, is seen in operation near the reception booth and a complete display of the incandescent lamps manufactured at the company's works in Harrison, N. J., is located in an adjoining section. In the department of motor applications, the General Electric Company, in conjunction with a number of manufacturers, have a very instructive and interesting display. The exhibit which would more particularly attract the casual sightseer in this section is probably the generator direct-connected to a 30-in. Pelton water wheel in operation so arranged as to show the perfect absorption of the energy in the water by the wheel buckets. A three-phase induction motor is shown direct-connected to a Platt Iron Works triplex pump, and an electric hoist manufactured by the Willamette Steel & Iron Company, Portland; a Price centrifugal pump direct-connected to an induction motor, as well as motor applications to horse clippers, printing presses, sewing machines, emery wheels and buffers, etc., etc., go to make up one of the most exhaustive exhibits of electric machinery and appliances at the Exposition.

The Wagner Electric Manufacturing Company, of St. Louis, Mo., exhibit in the Machinery, Electricity and Transportation Building a typical display of their electrical manufactures, particular prominence, however, being given to their single-phase machinery. The display comprises numerous types of individual single-phase, 60-cycle motors ranging in capacity from ⅛-hp to 7½-hp. Immediately adjoining the motors a good assortment of transformers are shown arranged consecutively according to their capacity, from 6-10 kilowatts to 15 kilowatts. Here also are exhibited switchboard appliances of various kinds, recording and indicating apparatus, among which may be mentioned 0 to 150-volt type F direct-current voltmeter, 60 to 110-volt power factor indicator with condenser, ammeters with series transformers, three-phase ammeters, fuse blocks, etc., etc., the whole going to make up a particularly distinctive and attractive display.

The Standard Underground Cable Company's exhibit comprises a typical display of cables, insulated wires, etc., manufactured by the company. Four large showcases are exhibited, side by side and facing the main entrance to their exhibit, each being devoted to the exploitation of a distinctive branch of cable manufacture. In the two center cases are shown samples of street railway material comprising bare and insulated wire and wire cables, wire for telegraph and fire alarm service, respectively, while to the left is a case containing samples of electric light and power cables, pole lines, etc., the remaining case being devoted to the various types of wire necessary for the modern telephone system. A short distance in front of the showcases are two spools of insulated and trolley wire having between them a pyramid of eight or ten different types and sizes of insulated wire. The display space is tastefully decorated with photographic views of the company's factory in Oakland, Cal., and gives one a comprehensive insight into the many and varied uses of wire rope and cables.

The Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa., displays a splendid assortment of electrical machinery and appliances. The 1,500 sq. ft. of space allotted to this company is literally covered with machinery and apparatus. The section devoted to their display of power machinery is particularly attractive, a very prominent feature being a Westinghouse-Parsons steam turbine direct-connected to a 400-kw generator set up immediately adjoining the main entrance to the exhibit, and so arranged as to show the interior mechanism of the turbine. Several types of smaller generators and a small Ohmen high-duty steam engine direct-connected to a 2-kw type "S" Westinghouse generator are situated in the western section of the display space and facing one of the main aisles of the building, while the interior is occupied by more power machinery, comprising among others, a motor-generator set. In the extreme southern portion, the Sanitary Devices Manufacturing Company display in conjunction with this exhibit a complete sweeper outfit driven by a type "S" motor. Near by is a hoist having for motive power a type "F" induction motor with controller and requisite appliances. The rear section contains some distinctive types of the Westinghouse transformers, a special feature in this connection being a 110-kw air blast machine. Immediately adjoining on the floor and suspended against the wall type "O. D." transformers ranging in capacity from ¼ kw to 25 kw, Standard switchboard instruments mounted on display boards and comprising voltmeters, wattmeters, ammeters, power factor indicators, etc., so arranged to exhibit their mechanical operations, are also seen in this vicinity. The display of the company's street railway appliances gives one a thorough insight into their standard street railway traction apparatus; among the machines here exhibited being a No. 92 direct-current railway motor of 50-hp capacity, showing the interior construction as well as an alternating-current, single-phase street railway motor of 75-hp capacity, having the commutator thrown back and a unit switch system of multiple control on a stand and with the cover off. The portable instruments manufactured by the company are displayed in a showcase opposite the main entrance to the exhibit, and directly in the rear is a type "C" three-pole, 33,000-volt, electrically operated circuit-breaker, a type "B" circuit-breaker for 2,300 volts, lightning arrester choke coil, a static interrupter, also a type "D" double-throw oil switch with fuses arranged on display boards. The display space is surrounded on three sides by enclosed Westinghouse arc lamps, hung on artistically designed iron goose necks, and in this connection it may be mentioned that the Machinery, Electricity and Transportation Building is illuminated by Westinghouse lamps of similar pattern.

Curtis Steam Turbines for Japan.

With the industrial awakening of the Island Empire has come a need for electric power not only for manufacturing purposes, but for transportation and for lighting. Japanese engineers are wide-awake, and their enterprise is nowhere more clearly indicated than in their adoption of steam-turbine electric-generating units. On July 29, 1904, the first shipment of steam turbines arrived in Japan via the steamship *Korea* from San Francisco. They were of 500-kilowatt capacity of the Curtis type, and were for operating the Shigai Railway in Tokio. Four weeks from their arrival they were in full operation. As significant of the success of these first units there have been ordered by the Japanese from the General

Electric Company, of New York, 37 Curtis steam turbines with electric generators with a total normal capacity of more than 35,000 horse-power. Of these, 11 units are now installed and in satisfactory operation.

The Japanese are not slow in adopting the electrical systems which will improve their manufacturing and transportation facilities and give the people better lighting service. They are using electricity for operating the street railways of their cities and for indoor and street lighting. In the use of electric power for machine shops, they are following only the best American practice, which, as a rule, requires electric motors mounted on each tool. The coal mines of Japan will eventually be operated electrically. Some of the turbines mentioned above are intended for the Miike coal mines on the Island of Kyushu. These are owned by Mitsui & Company, and will use two 1,000-kw Curtis steam turbines.

The Osaka Electric Light Company, which furnishes electricity to the city of Osaka, which has a population of over 800,000, is equipped entirely with American electrical apparatus, including six steam turbines of the same make. One of the largest electrical interests in Japan which has ordered some of the machinery referred to above, is the Tokio Street Railway Company, which furnishes transportation facilities for the city of Tokio, which has a population of 1,440,000. Its Japanese name is Tokio Shigai Tedsudo. Its franchise runs until 1952. Apparently, the municipal ownership idea has obtained some weight in Japan, for this franchise provides that after the year 1932 the municipality may purchase the property of the Company by paying a proper price for it. Although some English and German material is being used by this road, practically all the electrical equipment is American made. This includes five 2,000-hp. Curtis turbo-generator units, with power-house equipment and railway motors furnished by the General Electric Company, wheeler condensers and Brill trucks. Besides a small amount of German and English machinery, such as boilers and trucks, there are a few small dynamos which were made in Japan.

Heating and Ventilating the Majestic Theatre, Boston.

In the design of the heating and ventilating plant in the new Majestic Theatre in Boston, Mass., particular attention was given to securing and distributing evenly the fresh air supply, and arranging the vents so that they may be closed and the air re-circulated locally when the theatre is not in use. Considerable economy is thereby effected. The usual plenum chamber method is employed with branch delivery ducts leading to all portions of the auditorium. The chamber is formed by the open space or basement area beneath the sloping dress circle floor, into which the large blower delivers fresh air directly. The openings into the lower portion of the auditorium are made through the floor, while delivery to the balconies is similarly made through ducts leading to a supplementary plenum chamber beneath its floor. Vent connections are carried from the dressing and various other auxiliary rooms in the basement and from all portions of the auditorium to the gathering chamber beneath the floor, from which the air is exhausted by power.

The fresh air for the ventilating system is taken through inlets in the outside wall of the building about 30 ft. above the street. From these it is led downward through ducts built in the wall to a large horizontal concrete duct containing the heating coils for cold weather use. The fan is a 7-ft. three-quarter-housed blower, built by the B. F. Sturtevant Co., Boston, Mass., with a direct-connected motor of 10-hp. capacity, and is located in one corner of the plenum chamber, into which it delivers directly. The air is cleansed by a series of filters of cheese cloth upon light pine frames hung at the bottom of the vertical fresh air flues.

The air passes first through a large primary or tempering heater, and thence to the blower through the main heater, which may, however, be by-passed by the mixing dampers. The primary heater consists of eight sections of coils, six of which have 180 sq. ft. of heating surface and other two 160 and 140 sq. ft., respectively. The main heater is composed of 1,872 linear ft. of 1-in. pipe.

The principal delivery of fresh air to the auditorium proper is made through holes in the floor beneath the chairs. The chair legs away from the aisles are of a special design to cover these openings, which are distributed to the proportion of about one to every three chairs. There are about 300 of these openings in the main floor, each of which has a cross-section of about 27 sq. in. A similar distribution is made from the balcony floor, there being an auxiliary plenum chamber in the space underneath it, which is supplied from the main plenum chamber by two large galvanized iron ducts, each having a cross-sectional area of 650 sq. in. From this chamber air is admitted to the balcony through ½-in. holes in the risers, of which openings there are about 1,200, which gives an even distribution throughout the balcony.

The foul air is vented from the auditorium through openings in the ceiling, while for the spaces beneath the balcony and gallery there are vent openings in the side walls and ceilings, which connect with a Sturtevant motor-driven 60-in. exhauster, of special construction, located in the roof.

A novel feature of the ventilating system is the arrangement for circulating the air in the theatre when not in use. The fresh air inlet ducts leading to the heating coils and blower are provided with openings into the stage area, which are controlled by dampers in connection with those admitting air to the gathering chamber above the auditorium; by closing the latter and opening the connection from the cold air duct to the stage (which closes the connection with outside air) the air within the theatre travels in a closed circuit through the heating coils, plenum chamber, etc., with very economical results in the initial heating of the theatre in cold weather. The dampers in the ceiling of the auditorium, as well as the main damper in the roof opening, are controlled from the stage.

Pendant Switches.

Among the many electrical devices used in connection with electric lighting, the pendant switch is one on which improvements are made. The Sarco Company, of 906 Sixth Avenue, New York City, has just bought out a new device of this character. The Sarco pendant switch has no parts that get out of order. In appearance it is very neat, and is octagonal in shape. The inlet bushing is so arranged that it will take the regular lamp cord, and if reinforced cord is desired the bushing is unscrewed, which leaves a second bushing large enough for the heaviest style cord made. The

PENDANT SWITCH.

shell is taken off in a second's time by simply unscrewing, and a small catch keeps the two shells locked in position. The contacts are quick-make and quick-break. They cannot burn out, even if ten amperes of current is used. The working parts and contacts are contained in a heavy porcelain housing, which prevents any short-circuiting or grounding. The contact screws are large and so arranged that the cord is readily connected.

For operating the switch there are two buttons. One is inlaid with white pearl for lighting, and the extinguishing button is depressed so as to prevent the finger from slipping. A gentle pressure of the finger is all that is required.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Maturing crops exert a favorable influence on trade and industry. Fall business is improving, and the Western trade is opening a little earlier than it did last year. Weather conditions have favored crop growth and harvesting, fear of rust damage to spring wheat has disappeared, corn promises a record yield, and both demand and collections have improved as the result of early wheat crop movement in the Southwest. Midsummer quiet, so-called, is less than ordinarily manifest this year in trade, industry and financial operations. Bank clearings for July break all records for that month, failures are strikingly few for a normally dull period, and railway earnings show progressive gains on the best summers of previous years, with an increase of 8 per cent over July, 1904; the fiscal year showing 5 per cent advance in gross and 4 per cent gain in net over the preceding year. Best trade reports come from the Southwestern sections, where the new winter-wheat crop has been good and is moving freely. Demand and collections in that section embracing Oklahoma, Kansas, Missouri and Nebraska have all improved. Chicago reports many sales of new stocks to Southwestern buyers. In the Northwest trade sentiment is stronger, now that rust damage is no longer feared. Trade in the South is irregular. In Texas and Arkansas crop prospects tinge trade reports with pessimism; in the lower Mississippi Valley shotgun quarantines affect demand and shipment, but in the South Atlantic States and in the industrial centers the feeling is quite cheerful and fall business is looking up. Baltimore reports the advance guard of Southern buyers in town, while at New York and Boston buyers are numerous, with cotton goods selling most freely. Finished lines in iron and steel show increasing demands from the country reflected in continued active operations in most departments. Rail sales have been numerous, and all that can be delivered this year are already booked. Steel billets are firmer, and talk of premiums for deliveries is heard. A number of tinplate mills will resume operations next week. Some quietness in sheets and pipe is still noted, but the scrap market has strengthened after months of weakness, and old material is firmer. Furnace interests are free buyers of coke and ore. The lake ore traffic in July was in advance of any preceding month in the country's history. The tone of Southern iron is better at the leading Southern market. *Bradstreet's* reports 178 business failures during the week ending Aug. 3, as against 197 the week previous and 179 the corresponding week last year. The same authority states that the failures during the month of July were fewer than in any month this year and the lightest of any July for the past 12 years. The total number for the month was 704 against 771 in June and 774 in July last year. Copper advanced on heavy buying by domestic consumers. Lake and electrolytic are quoted at 15⅝ for spot and 15⅜ to 15½ for October deliveries.

PLANT FOR WASHINGTON.—Sealed proposals (in duplicate) will be received and opened by the U. S. superintendent Capitol Building and grounds, Mr. Elliott Woods, on Saturday, September 30, at 2 o'clock P. M., for furnishing all material, labor and other appliances, and erecting and putting in operation, in a building and on foundations to be provided by the United States, and in locations within the Capitol Building, Congressional Library Building and Senate and House Office Buildings, now under construction, a complete heating, lighting and power plant, including machinery, boilers, piping, electrical transmission, cables and conduits, appliances and all other equipment in said power house building and in the other buildings named, and as set forth on plans. The necessary plans showing the general layout, and complete information and specifications containing the same, will be furnished to responsible, intending bidders, and a certified check in the sum of $50, payable to the order of the undersigned must accompany requests for plans and specifications. Information as to the amount of check, surety bond or cash to be deposited with the bid, and the subsequent bond required for the performance of the contract, will be stated in the specifications. No bid will be considered which does not contemplate the erection of the complete plant as called for under the terms of the specifications.

NEW CONDUIT FACTORY.—The new factory of the American Conduit Manufacturing Co., Pittsburg, one building of which is now completed, is considered by President Flack as giving them what is perhaps the most modern and complete equipment in the field to-day for the production of rigid iron conduit. The main building, used for finishing and storing American Conduit, is an iron clad structure, well lighted and ventilated, 80 by 120 feet. The interior arrangements are such as to assure rapidity of handling and an absence of confusion in the final and important stages of manufacture. The shoemaker's wife is not always well shod, but in this case as a protection against fire all the wires in the new building are laid in American Conduit, with the result that insurance has been reduced to satisfactory proportions.

APPARATUS FOR CHICAGO.—Sealed proposals will be received by the city electrician of Chicago, Mr. W. Carroll, at his office, until 11 A. M., Thursday, August 17, 1905, for furnishing the city of Chicago with one thousand enclosed series alternating arc lamps, with the necessary transformers and regulators, in accordance with specifications on file in the office of said official. Delivery of three hundred of these lamps, with the necessary transformers and regulators to operate them, must be made within thirty days from date of award of contract. Delivery of the remainder of the lamps, approximately seven hundred, with the necessary transformers and regulators, must be completed inside of ninety days from award of contract.

BELL TELEPHONE OUTPUT.—The subjoined is the June instrument statement of the American Telephone & Telegraph Company:

June—	1905.	1904.	1903.	1902.
Gross output	120,555	83,312	87,608	96,653
Returned	52,427	44,144	42,189	41,741
Net output	68,128	39,168	45,419	54,912
Six months—				
Gross output	897,620	591.684	600,064	589,109
Returned	283,542	247,190	235,141	226,267
Net output	614,078	344,494	364,923	362,842
Total outstand	5,094,642	4,124,011	3,515,243	2,888,854

NAVY YARD SUPPLIES.—Bids will be received until August 22 by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the navy yards at Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C., and Norfolk, Va., electrical supplies, incandescent lamps, carbons, insulating tape, wire, testing set, generating set, projector, brass and steel conduit and fittings, etc.; also on September 5 for furnishing at the navy yards at Puget Sound, Wash., and Mare Island, Cal., insulators, generating sets, etc. Address H. T. B. Harris, Paymaster-General, U. S. N.

POWER PLANT CONTRACT.—The Board of Directors of the Winchester (Va.) & Washington City Electric Railway Company opened bids last week for the construction of the dam, power house and race-way along the Shenandoah River, near Millville, Jefferson County, W. Va., which is to furnish power for electricity for Winchester and other towns in this section. E. Purcel & Company, of Harrisonburg, Va., being the lowest bidders, were awarded the contract for $56,322.50. Eight other firms competed.

SIGNAL CONTRACTS.—The Hall Signal Company has recently closed contracts for automatic block signals with the Lake Shore & Michigan Southern Railroad, between Erie and Cleveland, 97 miles of two and four-track line; the Union Pacific, 39 miles of double track; the Chicago & Northwestern, 41 miles of double track, and the Delaware & Hudson Company, additional contract for 46 miles of partly single and partly double track.

THE WILLARD STORAGE BATTERY COMPANY, of Cleveland, which suffered a disastrous fire a few weeks ago, is now in full operation in all departments in a new factory building on Academy Street that city. The plant has been full equipped with the latest appliances for the manufacture of batteries, and the company is to be congratulated upon its rapid recovery from an almost total fire loss.

THE INTERNATIONAL TELEPHONE MANUFACTURING COMPANY, of Chicago, has recently installed in its manufacturing plant a gas engine for duplicate power equipment, and is running its factory night and day with double shift of men, to meet the rapidly increasing demands for its telephone equipment.

G. M. GEST, the expert subway contractor of New York and Cincinnati, has just been awarded a contract for the construction of an additional subway to the present system of the Cincinnati Bell Telephone Company in that city. The work is to be completed, so that it can be used before cold weather sets in.

APPARATUS FOR WINNIPEG.—Tenders are asked for by J. C. Gibson, fire, water and light commissioner, for a producer gas plant, and for an equipment of 2,500-hp. of engines and 500-kw. of electrical generating capacity. Bids will be received up to August 28 in separate sealed tenders.

TROLLEYS IN ADIRONDACKS.—Within a short time electric cars will be running between Paul Smith's and Lake Clear, and by next season an extensive trolley system will cover the southeastern portion of the Great North Woods, connecting Lake Champlain and Lake George with Schroon Lake, Lake Placid and intermediate points. Paul Smith has organized the Paul Smith's Electric Light & Power Company, and work on the road is well advanced. The route leads through the timber lands of the Paul Smith's Company. Lake Clear, from which the line will start, is the junction of the Adirondack Division of the New York Central and the Saranac Lake and Lake Placid branches of this road. The distance to be covered is about seven miles, and the road is being constructed so that Pullman cars may be drawn from Lake Clear Junction to the hotel company's grounds. Freight also will be carried on the trolley, making a big reduction in the cost of handling. In lumbering operations log trains will be at hand. A network of electric lines is to be built at once by the recently incorporated Ticonderoga Union Terminal Railroad Company. New York, Philadelphia and Chicago capitalists are backing the venture. With the expectation of hauling large quantities of pulpwood, the trolley lines will be constructed on a freight basis, but they also will be provided with passenger facilities. In Ticonderoga the ordinary trolley system will be used, but on account of the forest preserve laws, which forbid steam or third-rail systems in the woods, electric locomotives will be used, each having four 200-hp motors. The officers of the Ticonderoga Union Terminal Railway Company are: President, Northrup R. Holmes, of Troy; first vice-president, Altus B. Adkins, formerly Sheriff of Essex County; second vice-president, I. Rothschilds; treasurer, W. W. Richards, cashier of the National Bank of Ticonderoga; secretary, Frank T. Locke, president of the Ticonderoga Machine Company; auditor, Mortimer V. Drake; chief engineer, Frank B. Gridley, assistant city engineer of Troy. Options have been obtained by the company on all the electric power plants along its proposed routes. Dams for the development of power will be erected in the vicinity of Ticonderoga. It is expected that construction will be begun within six weeks.

PENNSYLVANIA RAILROAD.—Rumors have come from Pittsburg in regard to plans of the Pennsylvania Railroad to electrically equip its lines in the neighborhood of that city and compete with the traction lines for suburban passenger business. These reports have no present foundation, it is stated. There has been no discussion by the highest officials of Pennsylvania of any scheme of electric operation of the company's lines in the Pittsburg district and nothing of the kind seems at all likely to be taken up for some time.

SUPPLIES FOR PENSACOLA NAVY YARD.—Bids will be received until August 29 by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the Pensacola navy yard electrical supplies, incandescent lamps, etc.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was strong and there was a slight increase in activity at the close of the week. Good crop news from the west and the approaching sessions of the peace conference contribute to keep up bullish feeling among the professionals, while good earnings and favorable prospects for railroad traffic, together with the continued ease of money, check selling. Some new high-price records were made by leading railway stocks, notably Lackawanna, while various industrials, particularly American Smelters, were also strong. Bonds are steady, without much activity. All of the traction stocks, except Interborough Rapid Transit, were weak and closed with net losses. Brooklyn Rapid Transit's last quotation was 69½, which is a decline of ⅛ point, and Metropolitan Street Railway lost ⅜, closing at 127⅝. Interborough Rapid Transit closed at 219¼, which is a net gain of 5 points. The electric stocks took a downward turn and comparatively little business was done. Allis-Chalmers common and preferred both closed with fractional declines, the last prices being 18⅜ and 62, respectively. General Electric dropped from 181 to 178 and closed at the latter figure, which is a loss of 1¾ points. Westinghouse also closed at the lowest figure of the week—168—thus losing ½-point. Electric Storage Battery was an exception to the general run of electrical securities and made a net gain of 1½ points; closing at 83½, and Western Union also has a net gain of ⅛-point to its credit, the closing price being 93½. The curb market was generally higher at the close of the week, compared with a week ago, with the volume of business about the same as the previous week. The active feature was Chicago Subway, in which total transactions amounted to about $100,000 shares. After a rise of 4½ points, it broke sharply, losing all the improvement, then rallied somewhat, under what looked like manipulation by the interests which have been engaged in putting it up for some weeks past. The sharpest rise on the curb was made in Interborough, which gained more than 8 points, crossing 220, though unattended with any new developments. This was in line with the advance of high-priced shares on the Stock Exchange. Following are the closing quotations of Aug. 8:

NEW YORK

	Aug. 1	Aug. 8		Aug. 1	Aug. 8
Allis-Chalmers Co.	18	18⅜	Electric Vehicle pfd.	25	25
Allis-Chalmers Co. pfd.	62	60⅛	General Electric.	179	179¼
American Tel. & Cable.	90	90	Hudson River Tel.	..	..
American Tel. & Tel.	137	138	Interborough Rap. Tran.	215	218
American Dist. Tel.	29	29	Metropolitan St. Ry.	127⅛	127⅝
Brooklyn Rapid Transit.	68⅜	69⅝	N. Y. & N. J. Tel.	..	..
Commercial Cable	..	..	Marconi Tel.	..	..
Electric Boat	20	22	Western Union Tel.	93	93⅜
Electric Boat pfd.	60	67	Westinghouse com.	165	166
Electric Lead Reduction	..	..	Westinghouse pfd.	..	..
Electric Vehicle	18	19			

BOSTON

	Aug. 1	Aug. 8		Aug. 1	Aug. 8
American Tel. & Tel.	138⅛	138⅛	Western Tel. & Tel. pfd.	*99	99
Cumberland Telephone.	117¼	117	Mexican Telephone.	1¼	1¼
Edison Elec. Illum.	244	246	New England Telephone.	135	136⅛
General Electric.	180	179	Mass. Elec. Ry.	17¼	17⅜
Western Tel. & Tel.	18	*18⅛	Mass. Elec. Ry. pfd.	61	60

PHILADELPHIA

	Aug. 1	Aug. 8		Aug. 1	Aug. 8
American Railways.	51	52⅛	Phila. Traction.	..	..
Elec. Storage Battery.	82	82	Phila. Electric.	8⅝	8⅞
Elec. Storage Battery pfd.	..	..	Phila. Rapid Trans.	27⅜	29⅛
Elec. Co. of America.	11⅛	11⅝			

CHICAGO

	Aug. 1	Aug. 8		Aug. 1	Aug.
Central Union Tel.	..	..	National Carbon pfd.	117	115
Chicago Edison.	..	..	Metropolitan Elev. com.	24	24
Chicago City Ry.	*196	*196	Union Traction.	..	..
Chicago Tel. Co.	..	..	Union Traction pfd.	..	..
National Carbon.	63	60¼			

* Asked.

CENTRAL STATES TELEPHONY.—The Central Union Telephone Company has shown a great deal of activity lately. In Illinois twelve larger exchanges have been re-equipped, as follows: Alton, Belvidere, Canton, Centralia, Decatur, Edwardsville, Jacksonville, Kewanee, La Salle, Moline, Mount Vernon, Ottawa and Streator. Indiana has received eleven complete new exchanges at Auburn, Brazil, Crawsfordsville, Elkhart, Garrett, Lafayette, Lebanon, Mishawaka,, Newcastle, Peru and Shelbyville. Adequate outside facilities have been provided at each exchange. Additional switchboard sections have been installed at Butler, Indianapolis and South Bend. The work in Ohio has included the entire rebuilding of six large exchanges, as well as increasing the capacity of a dozen others. The smaller exchanges over the state, and, in fact, over the three states, have received all the improvements which their quota of business would at all justify. During the last few months the company has been absorbing independent telephone companies as follows: The entire 1,000 shares (par $50) of the Central Energy Telephone Company, of Franklin, Ind. (1,300 telephones), has been purchased for $115,000. Arrangements have been madt to sub-license all the independent exchanges in Jackson County, Ohio, the Jackson County Company adopting the Bell instrument in its exchanges, a total of about 1,800 subscribers. The United Telephone Company, of Bluffton, Ind., which owns the exchanges and toll lines in Wells, Grant, Blackford and Huntington counties, Ind., and has 5,000 subscribers, has become a sub-licensee of the Bell, using its instruments. The United has $480,000 bonds and $300,000 stock outstanding. The Citizens' Telephone Company, of Kokomo, has applied, or will apply, to the city authorities for an amendment of its franchise permitting it to enter into a contract with the Central Union.

INGERSOLL-RAND DRILL.—The Ingersoll-Rand Drill Company has been incorporated to take over the plants of the Rand Drill Company and the Ingersoll-Sergeant Drill Company. The new company will have an authorized capitalization of $3,000,000 in 5 per cent bonds, $5,000,000 in 6 per cent preferred stock and $5,000,000 in common stock. The Rand Company was acquired by the new company on the basis of $41.33 in bonds, $86.08 in preferred stock and $60.75 in common stock for each $100 of stock of the old concern. The Ingersoll-Sergeant Drill Company's preferred stock received $7.50 for each £1 share and Ingersoll-Sergeant Drill Company common stock received $10 preferred stock and $10 in common stock for each £1 share. The Ingersoll-Sergeant debentures will be paid off in the next fifteen months, the proceeds being raised by issue of Ingersoll-Rand new bonds. The new Ingersoll-Rand Company will have an outstanding capitalization of $2,000,000 bonds, $4,500,000 preferred stock and $3,000,000 common stock, application to list which on the Stock Exchange has been made. The earnings of the new corporation are expected to be about $650,000 annually, which will mean an earning capacity of 8 or 10 per cent. on the new common stock. No dividends will be paid on the common stock, however, for the present.

THOMSON-HOUSTON SECURITIES.—The trustees of the Thomson-Houston securities, Series D, have disposed of all the securities held in trust, and will make a division of the funds in their possession Aug. 28, 1905, on surrender of stock certificates, which will terminate the trust.

BROKERAGE OF ELECTRICAL PROPERTIES.—There is an increasing willingness on the part of the public to invest in public service properties, but the investor often experiences difficulty in learning about such properties if they are not quoted on the exchanges, while in that event they are too big a proposition to be considered seriously and singly by any individual, even if he be a millionaire. We are interested to note, therefore, that a definite announcement as to its engaging in brokerage work in regard to such properties is made by the Gas & Electric Development Company of Philadelphia and New York. This company buys and sells public service properties of the nature indicated, its compensation being based on a percentage of the selling price, and that percentage being determined by the value of the property, whether it be electric light, trolley, telephone or gas. It is needless to say that such work has to be done very judiciously and that unnecessary and harmful publicity has to be avoided. Reputable brokers have as much to lose through a plant being hawked around promiscuously and becoming stale as the plant owner himself. The Gas & Electric Development Company is composed of men who have been interested in public service properties for many years, and though they have been organized as a company for less than a year, they have already negotiated a number of sales in a manner satisfactory to both buyer and seller. The company has offices at 1328 Chestnut Street, Philadelphia, and 82 Beaver Street, New York City. The officers are: Harry C. Case, president; A. B. Beadle, vice-president and engineer, and W. W. Levering, secretary and treasurer.

SPRINGFIELD (MASS.) UNITED.—The report of the Springfield United Electric Light Company to the Gas and Electric Light Commissioners for the year ended June 30, 1905, shows clearly the large improvements made in the steam plant of the company during the past year. At the time of the closing of the state report a little over $175,000 had been put into this steam plant in the year. The electric plant had been increased not quite $30,000, while the electric lines, transformers and meters, in which items, of course, are included the underground conduit work which the company is forced by law to undertake, had increased in value during the year over $100,000. The company lays aside, as usual, $50,000 in its reserve for depreciation. The profits shown have increased from $81,286 to $88,604.29. The comparative statements for the two years follow:

	1905.	1904.
Assets.		
Real estate	$259,841.30	$256,367.95
Steam plant	272,727.91	95,169.13
Electric plant	334,149.19	305,794.93
Electric lines, etc.	643,355.99	540,250.07
Stock and merchandise	40,314.38	66,224.00
Sinking fund	61,000.00	52,500.00
Investments	457,800.00	457,800.00
Cash and debts receivable	47,999.69	47,209.03
	$2,117,188.46	$1,821,315.11
	1905.	1904.
Liabilities		
Capital stock	$800,000.00	$800,000.00
Debts	586,814.69	356,893.84
Profit and loss	88,604.29	81,268.47
Reserve for depreciation	285,000.00	235,000.00
Sinking fund	61,000.00	52,500.00
Capital stock premium	95,000.00	95,000.00
Bonds	200,000.00	200,000.00
Guarantee fund	769.48	.....
Deposits		652.80
	$2,117,188.46	$1,821,315.11

CHICAGO PNEUMATIC TOOL.—President Duntley, of the Chicago Pneumatic Tool Company, makes the subjoined semi-annual statement of profits for the half year ending June 30, 1905:

Profits for the half year		$413,941.54
Less—Depreciation of buildings, plant and machinery, including repairs and renewals of buildings and plant	$52,905.02	
Less—Written off for experimenting and perfecting new lines of tools	4,800.00	57,705.02
		$356,236.52
Less—Bond interest for the half year	$57,500.00	
Less—Sinking Fund Reserve	25,000.00	82,500.00
Profit available for dividend		$273,736.52
Less—Quarterly dividend No. 9 (1%)	$61,137.83	
Quarterly dividend No. 10 (1%)	61,137.83	122,275.66
Balance carried to surplus		$151,460.86
Surplus Account.		
Surplus brought from 1904	$254,030.82	
Less—Appropriation on account of development work and written off	28,593.51	$225,437.31
Surplus for the half year ending June 30, 1905		151,460.86
Surplus carried forward		$376,898.17

PHILADELPHIA BELL TELEPHONE.—A Philadelphia Bell Telephone director says that he estimates the gross earnings for the fiscal year ending next December 31, 1905, at about $4,170,000, which is the rate for the first five months of the year. In the summer months the business usually falls off somewhat because of the large number of people out of town, but against this will be the 17,000 gain in the number of telephones in use since the first of the year. The gross business indicated would be an increase of over $610,000 as compared with 1904. The recent merger of the several companies into the Diamond State Telephone Company was done because it is proposed to make some extensions in that territory. This was formerly covered by the local sub-licensee companies, but as they did not care to undertake the extensions, the Bell Telephone Company, of Philadelphia, will furnish the capital and control the Delaware Company by ownership of a majority of the stock, and not by ownership of all the stock as in the case of the Delaware & Atlantic. The Delaware territory extends over the Peninsula, south of Wilmington, from the Chesapeake Bay to the Delaware Bay, and is contiguous to the Cumberland Telephone Company. Treasurer Peirsol, of the Bell Telephone Company, of Philadelphia, says all of the new stock was subscribed for except a few odd fractional shares. This is a pleasing result and indicates the faith of stockholders in the company.

BONDS OF PARIS (ILL.) PLANT.—A. H. Bickmore & Co., of 30 Pine Street, New York, offer at par and interest $55,000 first mortgage 5 per cent 20-year gold bonds of the City Gas & Electric Company, of Paris, Ill., guaranteed by the National Light, Heat & Power Company. The total issue authorized is $150,000, of which $130,000 have been issued and $75,000 taken by local banks and investors. The National Light, Heat & Power Company, which controls and operates several public service corporations, guarantees the bonds of the constituent companies both as to principal and interest. The combined net earnings of the companies for 1904 were sufficient to pay the interest charges on the total present issue of bonds, 5 per cent on the preferred and about 4 per cent on the stock of the National Company, issued in acquiring the properties.

OPPOSITION NEW YORK TELEPHONES.—It is alleged that when Comptroller Grout returns from Europe the Atlantic Telephone Company will probably be given a franchise to operate in New York City. The company was organized under the laws of the State of New York, and has a present capital of $5,000,000. Its authorized capital is $25,000,000, and the directors of the company have also authorized the issuing of bonds to the amount of $15,000,000. The officials of the Atlantic Company expect to connect with the Interstate Telephone Company of New Jersey, a consolidation of North and South Jersey independent lines, which, it is claimed, will give it independent long-distance connection for more than 1,500 miles.

AMERICAN TRACTION & LIGHT shows as follows for the six months ended June 30:

	1905.	1904		Changes
Gross	$549,080	$496,823	Inc.	$52,257
Expenses	16,500	13,500	Inc.	3,000
Net	$532,580	$483,323	Inc.	$49,257
Year ended June 30:				
Gross	$1,203,761	$1,050,375	Inc.	$153,386
Expenses	21,993	31,500	Dec.	9,507
Net	$1,181,768	$1,018,875	Inc.	$162,893
Dividends	715,940	598,920	Inc.	117,020
Surplus	465,828	$419,955	Inc.	$45,873

DIVIDENDS.—The directors of the Niles-Bement-Pond Company have declared the quarterly dividend of 1½ per cent on the preferred stock, payable August 15. They also declared 3 per cent on the common stock, 1½ per cent payable September 20 and 1½ per cent on the preferred stock, payable December 2. The directors of the Pratt-Whitney Company, an allied concern, have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable August 15. The Woonsocket Electric Machine & Power Company has declared a quarterly dividend of 1¼ per cent.

CONSOLIDATION AT PADUCAH, KY.—The Stone & Webster Company, of Boston, Mass., has bought the Paducah City Railway Company, capital $300,000, bonds $650,000, 14 9/10 miles of track; Paducah Gas & Fuel Company, capital $200,000, bonds $100,000; Paducah Steam Heating Company, capital $100,000, bonds $50,000. They are interested with a number of Louisville people, represented by Mr. Charles Dallam, of Louisville, Ky. The local stockholders of the concerns will retain 30 per cent of their stock.

NATIONAL LEAD NEW STOCK.—The National Lead Company is increasing its capital stock from $30,000,000 to $50,000,000, presumably for the purpose of absorbing the United Lead Company. Negotiations looking to this have been under way for about a year. A short time ago the stockholders of the National Lead Company authorized the increase of capital stock, and it is expected that the announcement of the taking over of the United Lead Company will be made shortly.

LARGE LIGHTING CONSOLIDATION.—Notice of the merger of fifteen electric light and gas companies in Luzerne County, Pa., into one company, with a capital of $1,000,000 has been filed in the State Department, with the approval of Governor Pennypacker. The officers of the new concern are: C. H. Geist, Philadelphia, president; H. W. Noble, Detroit, vice-president; C. B. Kelsey, Grand Rapids, Mich., secretary and treasurer.

General News of the Week

The Telephone.

ANNISTON, ALA.—A. M. Brett and associates have applied for a franchise to construct and operate a telephone system.

EUREKA, CAL.—A telephone franchise has been sold by the City Council to W. W. Allen, an attorney, of San Francisco, for $3,000.

SOUTH MANCHESTER, CONN.—The Bolton & Coventry Telephone Company applied to the Southern New England Telephone Company to have the Bolton line connect direct with the Manchester exchange and eliminate the Bolton office. This proposition was accepted. Officers were also elected as follows: President, John Cairns; vice-president, H. T. Thompson; secretary, Andrew Kingsbury; treasurer, W. S. Pitkins.

CONWAY, ILL.—The Home Telephone Company has increased its capital stock from $6,000 to $10,000.

GENESEO, ILL.—The Geneseo Telephone Company has been formed with a capital of $2,500 by C. Tomlinson and George B. Detrich.

GALESBURG, ILL.—The Galesburg Union Telephone Company has certified to an increase in capital stock from $150,000 to $250,000.

URBANA, ILL.—The National Telephone & Electric Company has purchased the property owned by the Farm & City Telephone Company for $100,000.

PEORIA, ILL.—The Inter-State Telephone Company has opened a new exchange in Peoria. It has a metallic toll line from Princeton to Peoria, giving connection for the patrons of the Bureau County Independent Telephone Company with Peoria, Pekin, Bloomington, Streator, Ottawa and other cities.

FRANKLIN, IND.—The Central Union Telephone Company is establishing a new system in this city, which will cost $10,000.

KURTZ, IND.—The Brownstown Telephone Company has sold the Kurtz & Houston telephone plants to Dr. Bruce Fleetwood.

FRANKFORD, IND.—The New Long-Distance Telephone Company, of Indianapolis, has asked for a franchise in this city.

BOSTON, IND.—The Richmond Home Telephone Company is putting in a new exchange in this place with 40 subscribers.

CONNERSVILLE, IND.—Representatives of the Central Union Telephone Company have made flattering offers for a controlling interest in the Connersville Telephone Company. L. A. Frazer, secretary of the company, says the plant is not for sale.

KOKOMO, IND.—The Citizens Telephone Company, realizing that the amended ordinance which it had before the council was doomed to defeat, withdrew it. This ordinance would permit the company to enter into a contract with the Bell Company for long-distance service. The council was opposed to it, believing it was a step toward ultimate control of the local plant by the Bell Company.

KOKOMO, IND.—The City Council has found that the Central Union Telephone Company has a franchise after all. The Western Telephone Company was granted a franchise 22 years ago and this was afterward transferred to the Central Union (the Bell). The city clerk in revising the ordinances neglected to transfer the franchise provisions to the new ordinance. This led the Council to believe that the Bell Company had no franchise.

WABASH, IND.—The independent telephone lines of northeastern Indiana will be cut off from all connection with the 100 miles of toll lines and many important exchanges of the United Telephone Company, which has just been absorbed by the Bell. The principal points to which the independents will be denied access are Marion and Bluffton, but 60 minor exchanges will be cut off. The action is due to diversion of all toll business originating on the Bell lines from the independent toll lines to those operated by the Bell.

TAHLEQUAH, I. T.—The Pioneer Telephone & Telegraph Company has secured control of the Cherokee Telephone Company's property, and will merge the line into its own system. The length of the line is 35 miles.

EMERSON, IA.—The Mills County Telephone Company has been incorporated with $50,000 capital.

DUBUQUE, IA.—The work of installing the underground telephone system at Dubuque has begun. A new central exchange is also to be constructed.

WEST BRANCH, IA.—The West Branch Telephone Company has been organized; capital, $12,000. J. T. Butler and others are the incorporators.

DES MOINES, IA.—Plans for the new central exchange of the Iowa Telephone Company are now being drawn by Architect John Spencer, and bids will be asked for as soon as they are done. Meanwhile the work of installing the underground system in the business district has been begun, the contract having been let to the King-Lambert Company, of Des Moines.

FLINT, MICH.—The change from the old to the new system of the Michigan State Telephone Company in this city will take place this month. The change has involved an expenditure of about $50,000.

KALAMAZOO, MICH.—The City Council has given the Michigan State Telephone Company five years in which to construct its conduits and remove its poles and lines from Kalamazoo avenue. The council originally demanded that the work be done by June 15 of this year.

YPSILANTI, MICH.—The Washtenaw Home Telephone Company has opened an exchange in Ypsilanti. For more than a year the company was kept out of the city by the refusal of the Council to grant it a franchise. Finally it entered on its State rights, having previously offered several thousand dollars and a number of fire telephones in return for a franchise, but without success. An injunction secured by the city to prevent the tearing up of the streets for putting in conduits was dissolved.

BOVEY, MINN.—A franchise has been granted the Mesaba Telephone Company by the village of Bovey.

ADA, MINN.—Directors of the Norman County Telephone Company are contemplating the purchase of the Ada, Halstad, Shelly and Twin Valley lines. The Iron Range Company has offered these lines for $9,000.

ST. PAUL, MINN.—The Telephone News Company has been formed, with a capital of $10,000, by Albert M. Jennings, Chicago, Ill., and E. E. Hunt.

CARL JUNCTION, MO.—The Carl Junction Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are G. A. Welbourne, H. C. Welbourne and H. C. Robertson.

LINCOLN NEB.—The Hickman Telephone Company has been organized with a capital of $6,000, by Adam Brendle and J. F. Judah.

HARTINGTON, NEB.—The Cedar County Farmers' Telephone Company has been formed with a capital of $5,000 by A. H. Cressy and L. D. Greenwood.

JERSEY CITY, N. J.—The Merchants' & Miners' Telephone & Telegraph Company has been incorporated in New Jersey. Capital, $500,000. Incorporators: S. R. Peary, James L. Stewart and Joseph Gales, Jr.

ASHEVILLE, N. C.—The city of Asheville has passed an ordinance requiring the Asheville Telephone Company, the merger concern, to supply better service within 60 days or forfeit its charter.

DONNYBROOK, N. D.—The Donnybrook Telephone Company has been formed with a capital of $50,000, by Fred M. White and Wm. A. Sherman.

CASSELTON, N. D.—The Western Telephone Company has been chartered with a capital of $50,000. Incorporated by Oliver Dalrymple and John L. Dalrymple.

LOWELL, OHIO.—The Highland Telephone Company has been organized. J. D. Snyder is president; Daniel Henneman, vice-president; C. F. Shinn, secretary, and John Mattern, Sr., treasurer.

WILMINGTON, OHIO.—The Central Union Telephone Company is seeking a reduction of taxes. Six years ago the State Board fixed the valuation of telephone instruments for taxation at $10 a set. Since that time the patents have expired and instruments, it is stated, are now sold for $3 a set, but the tax valuation has remained unchanged.

DAYTON, OHIO.—The Central Union Telephone Company plans improvements in the future that will cost $300,000. The switchboard capacity of the exchange in the telephone building on Ludlow St. will be enlarged, and a group of cables will be extended as far west as the Home and as far north as Fairview Park. The underground system will be extended in every direction in the city and poles removed wherever possible.

HARDIN, OKLA.—The High Point Mutual Telephone Company has been chartered with a capital of $1,000. Incorporated by John H. Dickerman and J. W. Quillan.

HARRISBURG, PA.—The Woodcock Valley Telephone Company has been formed. Capital, $5,000. D. M. Summers, of Entrekin, is treasurer.

ROCK HILL, S. C.—J. H. Milling, of Rock Hill, W. S. Percival, of Ogden, and associates are organizing a company to construct and operate a telephone system from Rock Hill to Ogden.

ST. MATTHEWS, S. C.—J. E. Wannemacker, J. E. Morse and others have incorporated the St. Matthews & Cameron Telephone Company, with a capital of $1,000.

EDGEMONT, S. D.—The Edgemont Telephone Company has been formed with a capital of $5,000, by Arthur J. Colgan and John Waldron.

MEMPHIS, TENN.—The Cumberland Telephone & Telegraph Company will open a new line between Memphis and Jackson, Miss., building down the Yazoo Delta branch of the Yazoo & Mississippi Valley Railway via Lake Cormorant, Tutwiler, through Yazoo City to Jackson. The company is also building between West Point, Miss., and Meridian, which line, when completed, will give another route between Memphis and New Orleans. Connection is now available as far south as Macon, Miss. It gives connection between Memphis and New Orleans via the Illinois Central and the Yazoo and Mississippi Valley Railroads and the line via Macon and New Orleans will give the company three direct connections between Memphis and the Crescent City.

SAN ANGELO, TEX.—Robert Stein, owner of the Miles Telephone Exchange, has sold the plant and franchise to J. Evans, of Santa Anna.

SALT LAKE CITY, UTAH.—The Rocky Mountain Bell Telephone Company will build two additional stories to its exchange in this city and make a rear extension to the building of 70 feet. The new switchboard will have a capacity of 9600 lines. The estimated cost of the contemplated improvements is $250,000.

CRAIGS, VA.—The Craigsville & Bell's Valley Mutual Telephone Company has been formed, with a capital of $5,000, by J. B. Tuttle, president, and L. E. Hicks, secretary and treasurer.

GREENWOOD, WIS.—The Badger State Company is making arrangements to sell its local exchange to the local company.

MENOMINEE, WIS.—The Wisconsin Telephone Company will make improvements to its system in this city to cost $30,000.

MILWAUKEE, WIS.—Alderman Henry Smith has introduced an ordinance to grant a franchise to the Milwaukee Home Telephone Company.

Electric Light and Power.

ENSLEY, ALA.—At a mass meeting held here on July 27 it was voted to construct a municipal electric light plant. N. W. Scott is mayor.

DOUGLAS, ARIZ.—The Douglas Improvement Company has decided to improve the electric lighting service.

ANAHEIM, CAL.—An election will probably soon be held to vote on issuing $40,000 bonds for improving the water works and electric light plant.

DENVER, COL.—It is stated that the Denver Gas & Electric Co. will expend about $150,000 in improvements.

PLAINFIELD, CONN.—An electric power plant is to be built at the Quinebaug River, near the Canterbury bridge. The water power there has been examined by some railroad men who are favorably impressed towards utilizing it for trolley purposes.

MARIANNA, FLA.—The citizens have voted to issue $9,000 bonds to construct an electric light plant.

ST. AUGUSTINE, FLA.—The citizens have voted for a municipal electric light plant and extension of water works. A franchise for electric lighting was also voted to T. R. Osmond.

COCHRAN, GA.—This town has voted for $17,000 5 per cent. bonds for water and electric lights.

SHAWNEETOWN, ILL.—A. M. Searles has received a franchise for water works and an electric light plant.

ROODHOUSE, ILL.—The Roodhouse Light, Heat & Power Company has been incorporated, with a capital of $30,000. Edmund C. Kreider, Sr., is one of the incorporators.

MATTHEWS, IND.—Charles Sampson desires to install an electric light plant in this city.

FORT WAYNE, IND.—Contractors are examining plans for the $1,000,000 power house for the Fort Wayne & Wabash Valley road, bids for which will be opened early in August

JASONVILLE, IND.—The Jasonville Electric Company has incorporated with a capital stock of $9,000. David W. Wetnight, H. L. Hyatt and H. L. Hannah who are directors.

INDIANAPOLIS, IND.—Officials of the several roads centering at this city have decided on building a power, heat and light plant southeast of the Union Station train sheds, to cost $50,000.

GREENFIELD, IND.—The City Council has decided to repair the electric light plant. The proposition to take individuals into partnership with the city was not received favorably. Neither was it thought to be advisable to combine the electric and water plants.

PORTLAND, IND.—The City Council of this city has reduced the rate for electric light current to a point lower than that of any other paying plant in Indiana. The light committee and Superintendent Baily reported that it had been found possible to grant a reduction. The new scale is: For 10 kilowatts, 8 cents per kilowatt; 30 kilowatts, 7 cents, and 60 kilowatts or more, 6 cents. The minimum charge is reduced from 75 to 60 cents, the city furnishing the meter. The old rate ran from 9 cents to 7 cents and each rate was stationary to such an extent as to make the reduction equal to 30 per cent. The committee says a sufficient profit is left to pay all expenses of the electric light department, including salaries, and give the city its 70 street arc lights free. When the city plant was under private ownership these 70 arc lights cost $80 each per year.

INDIANAPOLIS, IND.—According to recent statistics gathered by the State Statistician for the year ending June 30, 1905, 32 cities of the 84 in Indiana owned their electric light plants, and 52 cities were lighted by contract with private corporations or parties. The entire cost of lighting for all the cities was $890,666.44. The cost of the 32 cities with municipal plants was $320,327.61, and for the 52 cities lighted by private contract $570,388.83. The receipts from this source in the 32 cities maintaining municipal plants was $345,961.46, leaving an overplus of $23,633.85 for these cities. The average cost per city of those owning plants was $10,010.23, and of those renting the lights was $10,960.15. The average cost of the latter was $955.92 per city greater than the former. Although the number of lights of each are not given, and for this reason no true basis can be had, yet the advocates of municipal ownership are claiming a victory over private management as to cost to the consumer. The total receipts of all the cities of the State maintaining electric light plants during 1905 was $10,022,550.48.

ELDORA, IA.—The Eldora Electric Light Company will make extensive improvements to its plant.

PANORA, IA.—The electric light company has under consideration the construction of an electric light plant on the river at Rees' Mill.

OTTAWA, KAN.—F. A. Sharpe, of Lawrence, has petitioned for a franchise for an electric light plant.

ALMA, KAN.—A company has been organized by local men at Alma, they are installing a small light plant, alternating system.

LEWISPORT, KY.—Jesse Emmick is interested in the construction of an electric light plant.

SOMERSET, KY.—Bids will be received until Aug. 14 by T. R. Griffin, mayor, and the board of council, for a 20-year electric light franchise.

STOUGHTON, KY.—Bids will be received until Aug. 12 by the Electric Light Committee for a 100-kw. belted 3-phase alternator; 100-kw. steam turbo-alternator; two switchboards with instruments; 75-light constant-current transformer; 50 series alternating-current enclosed arc lamps; water-wheel governor for two 100-hp. wheels; a 150-hp. boiler and a boiler feed pump and heater.

WILSON, LA.—The question of constructing water works and an electric light plant is under consideration here.

MARKSVILLE, LA.—Sealed bids for the construction of a system of water works and electric light for the town of Marksville, will be received up to 4 p. m. Aug. 24, C. Ashton Smith, Mayor.

OAKLAND, ME.—The Messalonskee Electric Company, whose incorporation was recently noted, proposes to construct an electric light plant at Oakland to cost $125,000. L. Metcalf, 14 Beacon St., Boston, Mass., is the engineer.

AUGUSTA, ME.—The Southern Power & Improvement Company has been organized at Augusta, for the purpose of manufacturing, generating, buying and selling electric energy for lighting, heating and power, etc., with $10,000 capital stock, of which nothing is paid in. President, I. L. Fairbanks, of Augusta.

OLDTOWN, ME.—The Milford Construction Company has closed a contract with Jas. B. Mullen, of Bangor, Me., to construct a dam and power-house. The plant consists of a concrete dam about 1,000 ft. long across Penobscot River at Oldtown giving about 25 ft. head and a power-house containing twelve 1,000-hp generators, direct connected to water wheels. The power produced by the new plant will be transmitted to Bangor, 15 miles away.

BALTIMORE, MD.—The United Electric Light & Power Company has awarded contracts for the equipment of its power station at Westport as follows: Eight boilers of 700 horsepower each from the Wilcox Boiler Company, of New York; four engines of 3,000 horsepower each and an overload capacity of 4,500 horsepower, from the McIntosh & Seymour Company, of Auburn, N. Y., and four generators of 200 kilowatts capacity and overload capacity of 50 per cent to the General Electric Company.

QUINCY, MASS.—The Quincy Electric Light Company may issue $50,000 stock at par, $100, to pay for additions to plant made prior to July 1.

BRIDGEWATER, MASS.—The property of the Bridgewater Electric Light Company has changed hands during the past week, the new owner being Lawrence Cleare of this town.

HUNTINGTON, MASS.—The gas and electric light commissioners have issued an order approving the issue of $5,000 of new capital stock by the Huntington Electric Light Company for the purpose of purchasing the electric lighting plant and business in Huntington, formerly owned and operated by ex-representative Henry E. Stanton.

FALL RIVER, MASS.—The Fall River Electric Light Company is to issue $250,000 capital stock, to be offered to stockholders at $130 a share. The proceeds of 190 shares must be used for the cancellation of a like amount of floating debt on account of the purchase of land, and proceeds of the remaining 2,310 shares are to be used in payment of additions made subsequent to May 1.

LEOMINSTER, MASS.—The Heat, Light and Power Corporation of Boston has made a deal for the purchase of the Leominster Electric Light and Power Company. The ratification of the deal and the transfer of stock will follow the annual meeting of the trustees of the Leominster company. The price agreed upon is about par for the capital stock of the Leominster company, which is $50,000. The Heat, Light and Power Corporation already operates several plants in Worcester county, besides others elsewhere.

SPRINGFIELD, MASS.—The Monument Mills Company, of Housatonic, which recently purchased the Callender and the old woollen company's water privileges at Glendale, is to merge the two powers. It will build a dam between the two old dams by constructing a canal about 1,600 ft. in length, which will carry water to a site just above the Callender mill, whence it will be conducted to a power-house through a steel pipe 10 ft. in diameter and about 200 ft. long. The power-house will be located on the site of the old Callender mill, and will contain at the start two units of 750 horse-power each.

CAMBRIDGE, MASS.—The Cambridge Electric Light Company has completed arrangements for a reduction in its tariff to customers to take effect from and after Oct. 1, 1905. The basic rate for incandescent house lighting will be changed from 16 2-3 cents to 15 cents per kilowatt hour. The old rate of 16 2-3 cents allowed a reduction of 15 per cent for prompt payment, making the rate 14.17 cents net. The new rate allows a reduction of 10 per cent, making the net price 13½ cents, a saving of .67 cent. In addition the company will supply free renewals of lamps, so that the total reduction to customers will be about 10 per cent. The reduced rates will also apply to small stores and offices.

ALPENA, MICH.—Richard Collins has been awarded the contract for the power house of the new water works, at $16,055.

ROSE CITY, MICH.—Frank G. Bell and James Monaghan have made application to the City Council for a franchise for an electric lighting plant.

MUSKEGON, MICH.—The Pere Marquette Light & Power Company is negotiating with the people of Hart village for the purchase of a part of the city lighting plant.

GRAND RAPIDS, MICH.—The city authorities have been requested to open negotiations for the lease of the municipal electric lighting plant to a syndicate of eastern capitalists.

KINGSLEY, MICH.—The village has let the contract for furnishing electric lights to A. Gibbs, of Mayfield, Mich. The contract calls for five arc lights and more to be furnished as needed. Mr. Gibbs will also furnish commercial lighting.

JACKSON, MICH.—The Commonwealth Electric Company has commenced the erection of a big dam in the Kalamazoo River, near Ceresco, five miles west of this city. It is the purpose of the company to furnish more direct power for the Jackson & Battle Creek Traction Company, and it is thought that 1,000 horse-power can be obtained from the dam.

BENTON HARBOR, MICH.—The power at the Buchanan village dam, which is controlled by Charles A. Chapin, is to be transferred in part to Benton Harbor and St. Joseph. Another dam will be constructed at King's landing, where Chapin has a large site. A recent decision of the Supreme Court gave Chapin the right to sell the power where he desired, despite the exclusive contract with Buchanan.

CLARE, MICH.—The village has renewed its contract with the Clare Electric Company for lighting the streets for five years at $4.90 per month

for each light. Senator Doherty desired a contract to the end of his franchise nine years hence and offered light for $4.75 a month if the longer contract was granted. The city expects to be in shape to take over the lighting plant at the end of the five-year contract. The rate established will make the cost of lighting the streets $800 a year.

ST. LOUIS, MO.—The Board of Public Improvements will receive bids on Aug. 15 for furnishing electricity at the city institutions for one year from September 1. During the present year the expense has been $22,000. The contract includes power for all of the fire engine houses and other city buildings.

FORT OMAHA, NEB.—Bids will be received until Aug. 21 by Maj. M. Gray Zalinski, Constructing Q. M., Army Building, Omaha, for an electric lighting system at Fort Omaha.

RENO, NEV.—A deal for the consolidation of Reno's two electric companies has been pending for some time, but H. C. Cutting, its promotor, has left the city, and it is believed that the project is now off.

CONCORD, N. H.—The Concord Electric Company has closed its plant at Sewall's Falls for repairs and improvements and is supplying electricity from its steam plant on Bridge St. and from Garvin's Falls.

KEARNY, N. J.—The Kearny Common Council has discovered that it has no power to issue bonds for a municipal lighting plant, and has instructed its Lighting Committee to make a contract with the Public Service Corporation to light the streets for one year only at the reduced price offered by the company—$97 a year for arc lights and $15 a year for incandescent lights. The reduced offer made by the corporation was for a term of five years, and it is probable that the company will refuse to renew the contract, which expires on Aug. 1 for a year at the reduced prices, and will compel the town to pay $100 a year for arc lights and $16 for incandescents.

CARLSBAD, N. M.—A large power dam has been finished to replace the one destroyed by the storm last fall, and this town is again lighted by electricity.

LAKE PLACID, N. Y.—The date of opening of bids for constructing an electric light plant has been extended from Aug. 3 to Aug. 14.

CHATHAM, N. Y.—The electric light plant at Chatham has been sold to the Lindewald Light & Power Company, which is composed of Chatham capitalists.

SALAMANCA, N. Y.—This village proposes to take over the present water and lighting plants on Jan. 1, 1906, if it is voted to do so at the special election, to be held soon.

SOUTHPORT, N. C.—The town of Southport is considering the question of a municipal electric light plant. Several bids for the plant have been received.

WINSTON-SALEM, N. C.—The Winston-Salem Power Company, with $125,000 capital, has been chartered in North Carolina, and will develop electrical properties, etc. F. H. Fries and others are the incorporators.

GREENSBORO, N. C.—The State has authorized the Greensboro Electric Company to increase its capital stock from $250,000 to $500,000, the additional issue being of preferred stock. John Kerr is the president of the company.

CHARLOTTE, N. C.—The development of the Catawba River by the Southern Power Company, of Charlotte, will, it is predicted, result in the establishment of many new small industries at points reached by the lines of the new $7,500,000 concern. A total of 75,000 horsepower will be developed.

URBANA, OHIO.—Architect Wm. Miller, of Springfield, is preparing plans for the $5,000 electric lighting plant, to be erected here.

LOCK HAVEN, PA.—The Electric Light Company has in contemplation the enlargement of its plant on E. Church St.

WOMELSDORF, PA.—Wm. H. Dechant, 536 Penn St., Reading, is preparing plans for the construction of an electric light plant at Womelsdorf.

HARRISBURG, PA.—The Harrisburg school district will install an engine and generator in the addition to the technical high school. Mr. H. E. Todd can give information.

READING, PA.—The Reading Illuminating Company is making preparations to construct a power plant and install the necessary equipment in the way of wires, cables, conduits, etc.

MILLERSBURG, PA.—Dreibelbis & Co., Reading, are completing plans for the construction of a 50,000-hp. plant about a mile north of Millersburg, along the Susquehanna River. The probable cost of the proposed work is $1,500,000.

SUMTER, S. C.—The Sumter Electrric Light Company has been incorporated, with a capital of $200,000.

ESSEX JUNCTION, VT.—L. M. Farnham, of Boston, has, with Mr. Nash, of Burlington, been in consultation with S. A. and C. W. Brownell regarding the development of the water power on the south side of the river for an electrical plant. Plans have been submitted and are under consideration.

STAUNTON, VA.—It is stated that a receiver has been asked for the Augusta Electric Company. The company has failed to pay interest, but claims a contract whereby forfeiture will not lie, and to test this point application has been made for a receiver.

TACOMA, WASH.—The Mountain Home Electric Company has been incorporated with a capital of $30,000, by J. J. Hewitt, of Tacoma, and Seymour H. Bell, of Sumpter, Ore.

SHAWANO, WIS.—The Flattock Water Power Company, of Shawano, has been incorporated, with a capital of $50,000, by H. C. Zachow, Chas. H. Hartley and Frank S. Baker.

FOND DU LAC, WIS.—The Independent Light, Heat & Power Company, of Fond du Lac, has been incorporated with capital of $25,000, by Robert Free, G. R. Hoffman and Frank D. Fulton.

LARAMIE, WYO.—W. C. Sterne, of Littleton, Col., is interested in the construction of an electric light plant at Laramie.

WINNIPEG, MAN.—Bids will be received by J. C. Gibson, chairman fire, water and light committee, until Aug. 28, for the supply of a producer gas plant, of a capacity of 2,500 continuous engine brake horse-power; also a 500-kw electric generating plant. Specifications may be obtained upon application to H. N. Ruttan, city engineer.

MOOSE JAW, N. W. TER.—Bids will be received until Aug. 21 by John D. Simpson, secretary-treasurer, for a 200-hp boiler, 350-hp engine, condenser, feed pump and heater, 225-kw. alternating current generator, exciter and switchboard.

NAPANEE, ONT.—Bids will be received until Sept. 1 by W. A. Granger, town clerk, for $35,000 electric light bonds.

The Electric Railway.

SAN FRANCISCO, CAL.—The Vallejo, Benicia & Napa Valley Railroad Company, which recently completed its line from Vallejo to Napa, contemplates an extension through the Napa Valley to Calistoga and thence into Lake County. J. W. Hartzell, the promoter, is endeavoring to arrange for a bond issue to provide for building an electric road from Vallejo to Suisun, Vacaville and Winters. It is the intention to connect with the Vallejo, Benicia & Napa Valley near Napa. The Monticello Steamship Company will make connections at Vallejo for San Francisco.

NEW BRITAIN, CONN.—Within a few weeks the Connecticut Railway & Lighting Company will abandon its central power station on Chestnut Street. The work of placing the cables so as to change the power system from the direct to the alternating current is now being pushed. When it is completed all the power for the operation of the trolley and electric lighting business in the New Britain district will be received from the plant of the New Milford Power Company at Bulls Bridge on the Housatonic River. It will come through the sub-station at Black Rock.

BOISE, IDA.—It is announced here that a company will shortly be organized for the purpose of constructing an electric railway from this city to Big Creek. The company will be incorporated with a capital stock of $10,000,000.

KANKAKEE, ILL.—The Kankakee Electric Street Railway System and Electric Park have been sold to a syndicate consisting of E. D. Risser, of Paxton, R. A. Cracken and others. The company's capital has been increased from $60,000 to $100,000.

ALTON, ILL.—The Edwardsville & Granite City Railway Company will increase its capital stock from $10,000 to $30,000, in order to enable it to absorb the Edwardsville, Alton & St. Louis Railway, which was organized to construct an electric railway from Mitchell to Edwardsville. The new line to Edwardsville is nearing completion.

FORT WAYNE, IND.—The plans for the $1,000,000 power house to be erected at Fort Wayne, Ind., by the Fort Wayne & Wabash Valley Traction Company, specify 10,000 horse-power to be furnished by turbine engines. A large electric crane will be part of the equipment. The building will be of pressed brick with the interior of glazed white tile.

FORT WAYNE, IND.—The extension of the Toledo & Indiana Electric Railway into Fort Wayne is now assured. The financing of the road is now completed with Lawrence, Barnum & Company and Patrick Hirsch, New York, as backers. The new company will be known as the Toledo, Fort Wayne & Western. The incorporators are the same men who filed an application for a line from Toledo to Cincinnati.

MAYSVILLE, KY.—The Maysville, Carlisle, Millersburg & Paris Traction Company has been formed with a capital of $30,000.

EASTON, MD.—There is a well-defined movement on foot to establish a peninsula electric railway through Elkton, Chesapeake City, Chestertown Centerville, Easton, Cambridge, Princess Anne, Salisbury, Berlin and Snow Hill to Ocean City. Back of the enterprise are capitalists from New York, Philadelphia and Baltimore. A right of way will be asked of the next Legislature, and, if it is granted, engineers will be put to work next April.

ATHOL, MASS.—It is said that consideration is being given here to a project to build an electric railway from Barre to Baldwinsville, running through Petersham, Phillipston and Templeton. In furtherance of this project, it is stated that J. H. Hutchins, of Athol, has secured control of excellent water power having its head in Queen Lake, Phillipston.

GREENFIELD, MASS.—The Connecticut Valley Street Railway Company will establish a power plant and contract for additional power to supply the whole system. The contract has not been signed, but it is understood it will be very soon, with the Greenfield Electric Light & Power Company. This movement contemplates the construction of a new transmission line from Greenfield to Hadley, a distance of 23 miles, which will be entirely independent of the present station in Hadley. The machinery for the sub-station will be supplied by the Stanley Electric Company of Pittsfield, contracts having been awarded. This improvement contemplates an outlay of some $50,000 for both the new line and the new plant.

GRAND LEDGE, MICH.—An electric railway between Grand Ledge and Lansing is being considered by the business men of the village.

BATTLE CREEK, MICH.—H. M. Griffin, president of the Battle Creek-Coldwater Electric Railway, announces that contracts are let for the construction of the road, steel bridges, brick and cement depots, cars and power.

ALPENA, MICH.—D. W. Closser and O. O. Black, working in the interests of capitalists, are securing right of way for an electric railway from Alpena to Long Lake. A stock company with a capitalization of $100,000 is to be organized.

YPSILANTI, MICH.—The Detroit, Ypsilanti, Ann Arbor & Jackson Railway Company is preparing for improvements in the plant here. The height of the smokestacks in the chimneys of the power house is to be doubled. New cars are being built, sheet iron being used on the exterior almost exclusively.

JACKSON, MICH.—The Jackson Consolidated Traction Company has promised to build a line to the city limits to meet the line of the Jackson & Lansing Traction Company. The Detroit, Ypsilanti, Ann Arbor & Jackson Railway will change its routing into the city next summer. The new routing will give a loop for local service between Jackson and Jackson Junction.

MANISTIQUE, MICH.—A committee of the Merchants' and Manufacturers' Association of this city has investigated the possibilities of an electric road to connect Manistique and Garden. The Manistique Light & Power Company offers to furnish power for operating the road, if it is built, for $10 per horsepower per year. E. E. Coombes, auditor of the Manistique, Marquette & Northern Railroad, estimates the total cost of the road at $600,000.

MARSHALL, MICH.—The Commonwealth Power Company has commenced the erection of a dam across the Kalamazoo River at Cresco to furnish power to the Jackson & Battle Creek Traction Company, which operates the line between Battle Creek and Jackson. Power has been obtained from Allegan, but frequent breaks in the high-tension wire between Allegan and Battle Creek have led the company to secure power nearer to the line.

SAGINAW, MICH.—The Saginaw & Southwestern Railway Company has changed its name to Saginaw Bay & Southwestern Railway. The terminus has been changed to include Bay City. The capital stock is increased to $100,000. The new company will take over the franchises, property and rights of way of the Saginaw Southern Railway Company and of the Bay City & Caro Railway. A. S. Courtright, of Lansing, has been appointed supervising engineer.

SULLIVAN, MO.—The Sullivan City Railway Company has been formed with a capital of $50,000 by J. B. Titus and W. A. Searle.

ST. LOUIS, MO.—The United Railways Company of St. Louis has notified the Postoffice Department that it will discontinue carrying the mails on street cars unless the rate of compensation is increased. The United Railways Company receives 13½ cents a mile, earned $32,950 for the 244,000 miles covered during the fiscal year ended June 30, and wants the rate increased to 25 cents a mile.

GRAHAM, N. C.—The Alamance Street Railway Company, of Graham, is issuing bonds for a street railway. An electric light plant is also being erected at Graham.

ALBANY, N. Y.—The Niagara Falls & Lockport Electric Railway Company has been formed with a capital of $200,000. Edward Michael and Clark L. Ingham are interested.

GLENS FALLS, N. Y.—The Hudson Valley Railway Company directors have elected the following officers: A. B. Colvin, president and general manager; J. W. Herbert, first vice-president; G. A. Heimie, second vice-president; W. L. Kiley, secretary; C. A. Gardiner, general counsel.

TROY, N. Y.—It is reported that work will be started within a month on an extensive system of electric railways connecting Lakes Champlain and George with Schroon and Placid Lakes. The company was recently incorporated under the name of the Ticonderoga Union Terminal Railroad Company, and is promoted by New York, Philadelphia and Chicago capitalists. The company intends to erect dams for the development of power. Options have been secured on desirable water-powers. The directors are I. Rothschild, A. B. Adkins, A. H. Wood, F. B. Wickes, M. V. Drake and W. W. Richards, of Ticonderoga, and Frank B. Gridley and N. R. Holmes, of this city.

ST. CLAIRSVILLE, OHIO.—The franchise for the Wheeling Traction Company's up-the-river line has been granted.

NEWARK, OHIO.—The Council will be asked for a franchise for the Newark, Martinsburg & Mt. Vernon Electric Railway.

WARREN, OHIO.—The Youngstown and Ohio River Traction Company, which was promoted two years ago by Max P. Good, and some other Cleveland people, is to be built.

BARBERTON, OHIO.—The resolution authorizing the mayor and clerk of the city to advertise for bids for the construction of a street railway line in this city has been adopted.

CLEVELAND, OHIO.—The new trolley line to be built from Erie to Cambridge Springs, and known as the Erie, Cambridge, Union & Corry Railway Company, has been incorporated.

COLUMBUS, OHIO.—The Columbus, Delaware & Marion Interurban Railroad is to be extended to Bucyrus. The company has been incorporated with a capital of $500,000. John C. Webb is president.

OKLAHOMA CITY, O. T.—The Oklahoma Electric Railway Company, of Tecumseh, O. T., has been incorporated, with $250,000 capital stock, to build 10 miles of electric railway out of Shawnee, in Pottawatomie County. The incorporators are: Alfred Hare, E. H. Milburn, E. T. Fullerton, E. J. Dickerson and Chas. Blickenderfer.

WAYNESBORO, PA.—Surveys for the proposed Waynesboro-Hagerstown trolley line have been completed, and franchises from the various towns along the route will now be sought. As soon as these are all obtained construction work will be commenced.

SCRANTON, PA.—The Scranton, Factoryville & Tunkhannock Railway has sold its franchise to the Northern Railway Company. The franchise gives the right to construct a road to Tunkhannock. Former Mayor W. L. Connell is president of the Northern Company.

YORK, PA.—The plant of the Delta Electric Light Company, located along Muddy Creek, has been purchased by the York Furnace, Pequa & Lancaster Electric Railway Company. The purchase was made for the purpose of furnishing power for the proposed new trolley extension into York County.

CHAMBERSBURG, PA.—It has been practically decided by the Chambersburg, Greencastle & Waynesboro Electric Railway Company to build the extension between Greencastle and Chambersburg. Surveys have been made of the route and estimates of the cost presented to the board of directors.

HARRISBURG, PA.—A charter has been issued at the State Department to the Johnstown Terminal Street Railway Company, capital $10,000. John G. Gilbert, of this city, is president, and the directors are: James C. Thompson, Jacob T. Snyder, William S. Tunis, Edward Holbert and John G. Gilbert.

WEST CHESTER, PA.—The West Chester Street Railway Company has filed papers for two extensions. One begins at a point on the West Chester-Lenape-Kennett line, between Unionville and Kennett Square, and runs to Unionville, London Grove and Avondale. The other extension is from a point near Pocopson to Kennett Square.

SCRANTON, PA.—Prospects for the early building of the line of the Scranton, Factoryville & Tunkhannock Electric Railway, between this city and Tunkhannock, with a spur to Lake Winona, are much brighter now that the Northern Electric Railway Company has obtained control of 90 per cent of the stock of the company. A. J. Connell is president of the Northern Electric Company.

PHILADELPHIA, PA.—The properties and franchises of the Lehigh Valley Traction Company and its affiliated corporations bought at the several foreclosure sales have been conveyed to the Lehigh Valley Passenger Railway Company, the Philadelphia & Lehigh Valley Passenger Railway Company and the Allentown & Slatington Passenger Railway Company, respectively. The boards of these several reorganized companies met for organization and the following directors and officers were elected: Directors, Tom L. Johnson, Arthur F. Newbold, Harry C. Trexler, E. B. Smith, George Q. Albright, William F. Harrity and George H. Frazier. The boards elected the following officers: President, Harry C. Trexler; vice-president, Edward M. Young; secretary and treasurer, George H. Frazier; general manager, Warren S. Hall, and auditor, C. M. Walter. This action is a step toward the merger of all the properties into one company—the Lehigh Valley Transit Company. The organization of this company will take place shortly.

New Industrial Companies.

THE DODD & STRUTHERS COMPANY, of Des Moines, Ia., has been formed with $750,000 capital, to manufacture copper cable, lightning rods, etc.

THE BURN-PETERIT MANUFACTURING COMPANY, of New Haven, Conn., has been formed with a capital of $300,000 paid in, $400,000 specified, to make gas and electric lighting fixtures. This concern will occupy a portion of the plant already taken by the W. S. Burn Company in Fair Haven.

THE CUBA EASTERN TERMINAL COMPANY has been organized at Portland, Me., for the purpose of constructing, maintaining and operating railroads, telegraph and telephone lines, gas and electric works, etc., with $200,000 capital stock, of which $500 is paid in. Officers: President, H. L. Cram, of Portland; treasurer, B. L. Stewart, of Portland.

THE DELANY HOLDING COMPANY has been organized at Augusta, Me., for the purpose of acquiring the United States rights for the system of rapid automatic telegraphy devised by Patrick Delany, of South Orange, N. J., and to manufacture and deal in all kinds of electrical machinery, apparatus, devices, supplies and materials, with $1,000,000 capital stock, of which nothing is paid in. Officers: President, A. P. Bibber, of Augusta; treasurer, E. E. Penney, of Augusta.

THE STANDARD METALWORK COMPANY has been formed by the G. H. Bushnell Press Company, Thompsonville, Conn., for the purpose of conducting the manufacture of large pipe bends with improved joints for high pressure steam service and difficult metal work generally, including steam superheaters, condensers, feed water heaters, as well as appliances for refrigerating, evaporating, distilling, etc., Mr. James A. Colvin is proprietor, Mr. Mark Worth Bushnell, business director, and James Acton Miller, mechanical engineer and director, the latter having been engaged a number of years in this class of special work.

Legal.

THE LA ROCHE ESTATE.—Surrogate Fitzgerald of New York has reserved decision in an action brought to determine just how the estate of Frederick A. La Roche, the electrical engineer and automobilist, should be distributed. Mr. La Roche died in March last, and when it was found that he had made no regular will to dispose of his estate, estimated at a million dollars, his wife produced a letter at the Surrogate's office, offering it as a will. The letter had been written by Mr. La Roche to his wife two years before he died, at a time when he was about to start in an automobile race. He wrote that in case he met with an accident and died she, his wife, was to receive all of his possessions, which he named in detail in the letter. The husband's relatives, who claim a share of the estate, contended that the letter was practically worthless, as it was intended simply for use in case Mr. La Roche met with an accident at the time the letter was written. As the race did not result in his death, his relatives, including his aged father, two brothers and three sisters, now want the letter-will pronounced void.

Obituary.

MR. C. S. DILL, superintendent of the municipal lighting plant at Goshen, Ind., was electrocuted there on the night of August 4 through some inadvertence while testing an arc lamp.

DR. A. M. BELL.—The death occurred at Washington, on August 7, of Dr. A. M. Bell, father of Prof. Alexander Graham Bell. He was born in Scotland in 1819 and all his life was distinguished as an expert on articulation, vocal expression, elocution, phonetics, etc. In 1881 he permanently settled in Washington, D. C., and engaged in literary work. His numerous publications treating of elocution, vocal physiology and defects in speech, dating from 1845 to 1898; also on phonetic and visible speech, 1866 to 1898, and also on phonetic shorthand writing, 1852 to 1857, are accepted authorities on these subjects. In 1885 Prof. Bell was elected a fellow of the American Association for the Advancement of Science. He was an active member of the Modern Language Association, and of various scientific and educational organizations in the United States. He also held a fellowship in the Educational Institute in Scotland, and in the Royal Scottish Society of Arts.

Personal.

MR. J. R. McCOLL, who was until the close of the last college term, associate professor of Steam Engineering at Purdue University, has decided to take up commercial lines, and has accepted a responsible position in the engineering department of the American Blower Co., at Detroit.

DR. ALBERTO PIRELLI, of Milan, Italy, who has been making a trip of several weeks in this country, visiting rubber works, insulated wire factories, etc., sailed on Tuesday for England by German liner. It is his hope that many American electrical engineers will visit the great Milan Exposition next year.

MR. H. SOMMERS has been made general superintendent of the Rocky Mountain Bell Telephone Company. He was formerly superintendent of the Montana division, with headquarters at Helena. From Helena he was transferred to Salt Lake, to be superintendent of that division. He has proven himself worthy of his several rapid promotions, and is one of the most efficient officials of the company.

MR. EDWARD ROSEWATER, the famous old-time telegrapher and veteran editor of the *Omaha Bee,* one of the leading newspaper properties of the West, has recently contributed to that journal a brief batch of personal recollections of some of the men he has met in the electrical field. The list includes Prof. Joseph Henry, T. A. Edison, A. G. Bell, M. I. Papin, Anson Stager, P. B. Delany, James D. Reid. Mr. Rosewater established for Henry the first weather bureau west of the Mississippi River.

MR. W. M. LEWIS for a number of years superintendent of the gas and electric interests of the Public Service Corporation's plants at Raritan, Somerville, Finderne and Boundbrook, N. J., has resigned, and has become the general manager of the Rockville Gas & Electric Co., of Rockville, Conn. Mr. Lewis has acquired an enviable reputation as a gas and electrical manager, and is expected to accomplish noteworthy results in his new sphere of activity.

MR. PAUL J. CHALLEN, assistant to the manager of the Green Fuel Economizer Company, has recently accepted a position with the Stirling Company at their Philadelphia office. Mr. Challen has been connected with the Green Fuel Economizer Company since they started manufacturing in this country, 13 years ago. As designing and constructing engineer he has had a large experience and opportunity to study various types of boilers and their operation.

MR. S. M. KINTNER.—Mr. Samuel M. Kintner, for some years professor of electrical engineering at the Western University and for years the associate of Professor Reginald A. Fessenden in his experiments in wireless telegraphy, has been tendered the position of associate professor of electrical engineering in the Carnegie Technical School, with Mr. A. J. Wurts, for many years technical expert at the Westinghouse Electric & Mfg. Company. Mr. Kintner is now expert with the Westinghouse Company.

MR. HOWARD M. POST has just taken the position of advertising manager for the Kellogg Switchboard and Supply Company of Chicago. His experience in the telephone field dates back to 1899, when he entered the telephone installation dpartment of the Western Electric Company, in which department he remained for three years, installing exchanges in different parts of the country. He resigned this to accept a position as assistant telephone engineer with the Kellogg Switchboard & Supply Company in 1902, which he has held until the present time. During this interval he has made a number of telephone inventions, which were assigned to the company. He is therefore well equipped to handle intelligently the extensive advertising of this company.

Trade Publications.

THE SARCO COMPANY, 906 Sixth Avenue, New York City, has issued a neat little memorandum book in the shape of its new pendant switch. Copies will be furnished to electrical contractors free on application.

THE AITON MACHINE COMPANY, 126 Liberty St., has just issued its bulletin 79, illustrating one of its horizontal types of cabling or closing machines for laying up large cable. Specifications and quotations will be cheerfully furnished upon application at the New York office of the company.

AMERICAN BLOWER CO., of Detroit, Mich., issues as its illustrated sectional catalogue No. 18, a special pamphlet descriptive of its A. B. C. exhaust fans for heating and drying plants, removal and conveying of dust and shavings, handling of wool and cotton, etc. Several of the types are shown equipped with electric motor, making a compact, economical and efficient outfit. Data are given as to these in all sizes.

News of the Trade.

THE L. B. ALLEN CO., INC., 1332 Columbia Ave., Chicago, Ill., maker of the Allen soldering sticks, paste, salts, etc., has opened an office at 97 Warren St., New York, in charge of Mr. A. Hall Berry.

THE NATIONAL TUBE CO. has placed a large and important order for immediate execution, with the American Blower Co. of Detroit. The contract embraces heating equipment for their five new butt weld mills at Lorain, O.

THE PRATT & WHITNEY COMPANY, of Hartford, Conn. has made arrangements with the C. T. Patterson Company, Ltd., of New Orleans, La., to represent its small tool department on the Southwest territory. The Patterson Company has a very complete line of the small tool product, and is in a position to fill orders from its New Orleans establishment.

THE MOLONEY ELECTRIC COMPANY has opened an office in the Old Colony Building, Chicago, and has placed it in charge of Mr. Francis Raymond, formerly of the General Incandescent Arc Light Company. The Moloney Electric Company has found it necessary to take this step owing to the large transformer business which it has worked up in the Chicago territory.

THE ATWATER KENT MANUFACTURING WORKS, of Philadelphia, manufacturers of ignition specialties, formerly located at 112 North Sixth Street, are now located in their new home, a modern, fireproof building at 42, 44 and 46 North Sixth Street, where they have a considerable increase in floor space. Their new facilities promise a great increase in the output of the ignition specialties which they make.

COOKSON STEAM TRAP AND SEPARATOR.—The D. T. Williams Valve Company, Cincinnati, O., has concluded arrangements for the exclusive manufacture and sale of the Cookson steam trap and separator, formerly manufactured by the Cookson Steam Specialty Company, of Cincinnati. It has purchased the patents, patterns and good will of Thomas J. Cookson, and the exclusive right to manufacture his trap and steam specialties. This trap is very well known throughout the country, and is handled by the majority of jobbers.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUGUST 1, 1905.

[Conducted by Rosenbaum & Stockbridge, Patent Attys., 140 Nassau St., N. Y.]

795,820. SYSTEM FOR THE SELECTION OF ELECTRIC CIRCUITS; Anson G. Cox, Boston, Mass. App. filed Jan. 27, 1902.

795,821. UNDERGROUND CONDUIT; Henry T. Craven, Vineland, N. J. App. filed May 24, 1904. The conduit is provided with specially arranged drainage grooves, and has in addition a flexible protecting strip which lies in the usual groove or slot, and is temporarily raised therefrom by the passage of a car.

795,836. SELECTIVE CALL APPARATUS; John A. Hulit, Topeka, Kan. App. filed Sept. 3, 1904.

795,838. ASYNCHRONOUS ELECTRIC MOTOR; Paul Jigouzo, Vanves, France. App. filed Dec. 1, 1902. (See Current News and Notes.)

795,843. SYNTONIC SPACE TELEGRAPHY; Oliver Joseph Lodge, Birmingham, and Alexander Muirhead, Shortlands, England. App. filed March 21, 1902. (See Page 258.)

795,851. SYSTEM FOR SELECTING ELECTRICAL CIRCUITS; Albert D. Neal, South Boston, Mass. App. filed Oct. 18, 1901.

795,852. ELECTRICAL RELAY; Albert D. Neal, South Boston, Mass. App. filed Mar. 4, 1902. A pole changing relay comprising a pair of separate magnets which are energized successively. The energization in one order of succession makes connections of opposite polarity to those made when the magnets are energized in the opposite order.

795,857. METHOD AND MEANS OF SIGNALING; Frank W. Prentice, Braddock, Pa. App. filed Nov. 19, 1902.

795,861. ALTERNATING-CURRENT INDUCTION-MOTOR; Leo Schuler, St. Louis, Mo. App. filed July 16, 1904. (See Current News and Notes.)

795,864. REVERSING MECHANISM; Judson Shoecraft, Eskridge, Kan. App. filed Dec. 27, 1904. A semaphore arm is operated by a pneumatic cylinder to which air is admitted at either end by a two-way cock. The cock is connected to a motor-driven gear wheel which is turned in opposite directions according to which way the current traverses the motor.

795,867. ELECTRIC HAND LAMP; Herman F. Stakelbeck, Philadelphia, Pa. App. filed Dec. 16, 1904. Relates to a construction of hand lamp in which the wires are guided by a split insulating ferrule, or bushing, which clamps the wires when the handle is screwed in place.

795,872. TELEPHONE-EXCHANGE; Harry G. Webster, Chicago, Ill. App. filed Nov. 16, 1904.

795,886. MAKING ALUMINUM; Anson Gardner Betts, Troy, N. Y. App. filed April 1, 1903. (See page 272.)

795,887. ELECTROLYTICALLY REFINING SILVER; Anson Gardner Betts, Troy, N. Y. App. filed March 8, 1905. (See page 272.)

795,910. CONDUCTOR SUSPENSION DEVICE; George F. Hagerman, Chelmsford, Mass. App. filed Nov. 22, 1904. Is made from a single piece of resilient wire, and has a cable supporting ring depending from a pair of short helical sections which surround the guide wire and serve to suspend and hold the ring in place.

795,956. PROCESS OF ELECTRICALLY HEATING; Eugene A. Byrnes, Washington, D. C. App. filed Dec. 10, 1904. The water is made to traverse a porous cup, composed of graphite silica and a bond of any suitable clay. The cup is simultaneously traversed and heated by an electric current.

795,958. CONTROLLER FOR ELECTRIC CIRCUITS; Fred Cedergren, Chicago, Ill. App. filed Dec. 17, 1904. A small rheostat especially adapted for medical batteries. Has a pair of controller arms, one of which is turned to suit the general strength of the battery, and the other of which is manipulated according to the requirement of the patient.

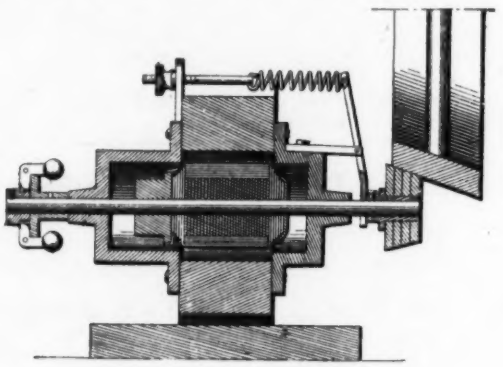
795,961. TELEPHONE-EXCHANGE SYSTEM; Elmer R. Corwin, Chicago, Ill. App. filed Sept. 3, 1904.

795,983. SPARKER; Alpha R. Joy, Wapello, Iowa. App. filed Sept. 1, 1904. An ignition dynamo for gasolene engines in which a conical pulley is moved away from the driving wheel by a centrifugal governor when the speed exceeds a certain amount.

796,022. CUT-OUT FOR TELEPHONES; John Andrew Tornquist, Clinton, Ia. App. filed Oct. 6, 1904.

796,029. PLUG SWITCH; James I. Ayer, Cambridge, Mass. App. filed Aug. 12, 1904. A floor switch in which an insulating cup is inset into the floor and has a pair of spring blades which are aligned with corresponding openings in the cover. The plug has projecting studs which pass through the openings and engage the blades.

796,031. ELECTRICAL MEASURING INSTRUMENT; Thomas Duncan, Chicago, Ill. App. filed June 26, 1901. This and the following 39 patents belong to a single series issued to the same party, and relate generally



795,983.—Sparker.

to electric meters. This particular patent and the one following relate to a phase-measuring device, and have coils at different angles in which a definite amount of lag is produced by impedance windings, whose effect is strengthened to turn the indicating pointer in an appropriate direction by variations in the working current lag.

796,032. ELECTRICAL MEASURING INSTRUMENT; Thomas Duncan, Chicago, Ill. App. filed June 26, 1901. In this patent the coils are mounted co-axially, two of them being stationary and in planes at right angles to one another, while the other two are movable and located in planes at right angles to one another.

796,033. ELECTRIC METER; Thomas Duncan, Chicago, Ill. App. filed June 26, 1901. The series of ten patents beginning with this number, all relate to systems of gearing within the meter by which the latter is made to directly indicate in dollars and cents, the amount of current consumed, and to automatically apply the discounts, rebates and excess charges, according to the contract, depending on the way in which the lamps are used.

796,034, 796,035 and 796,036. ELECTRIC METER; Thomas Duncan, Chicago, Ill. App. filed July 3, 1901.

796,037 to 796,042, inclusive. ELECTRIC METER; Thomas Duncan, Chicago, Ill. App. filed July 11, 1901.

796,043. ELECTRIC METER; Thomas Duncan, Chicago, Ill. App. filed July 18, 1901. The series of 18 patents, beginning with this number, relate generally to meters for charging storage batteries. The meters are arranged to register in the proper direction when the battery is charging or being discharged. Among other special features is one in which a spring exerts a constant torque upon the movable part of the meter so that the latter rotates very slowly even when no current is being used. This corresponds to the amount of leakage of the battery, so that the meter automatically shows when the battery needs recharging.

796,044. ELECTRIC METER; Thomas Duncan, Chicago, Ill. App. filed July 18, 1901.

796,045 to 796,048, inclusive. ELECTRIC METER; Thomas Duncan, Chicago, Ill. App. filed July 18, 1901.

796,049 to 796,056, inclusive. ELECTRICAL MEASURING INSTRUMENT; Thomas Duncan, Chicago, Ill. App. filed Aug. 26, 1901.

796,057. METER; Thomas Duncan, Lafayette, Ind. App. filed Jan. 2, 1902.

796,058 and 796,059. METER; Thomas Duncan, Lafayette, Ind. App. filed Jan. 8, 1902.

796,060. ELECTRIC METER; Thomas Duncan, Lafayette, Ind. App. filed Jan. 8, 1902.

796,061. INDICATING INSTRUMENT; Thomas Duncan, Lafayette, Ind. App. filed Jan. 8, 1902. Has a permanent magnet with a curved pole piece over which moves a coil carried by the pointer. Screws are provided to shunt the magnet circuit and are adjusted from time to time to compensate for the weakening of the magnet.

796,062. METER; Thomas Duncan, Lafayette, Ind. App. filed Jan. 8, 1902. A coin-controlled meter in which the coins unlock a star wheel and permit a one-tooth rotation thereof.

796,063. AUTOMATIC SWITCH FOR STORAGE BATTERIES; Thomas Duncan, Lafayette, Ind. App. filed Jan. 8, 1902. This patent and the following one relate to an automatic switch by which a storage battery is cut out of circuit when the battery has been sufficiently charged. They involve a mechanical attachment on the meter register which throws a circuit breaker.

796,064. AUTOMATIC SWITCH FOR STORAGE BATTERIES; Thomas Duncan, Lafayette, Ind. App. filed Jan. 8, 1902.

796,065. METER; Thomas Duncan, Lafayette, Ind. App. filed Apr. 28, 1902.

796,066. ELECTRIC METER; Thomas Duncan, Lafayette, Ind. App. filed July 26, 1902. A multi-rate meter in which the current is directed through the meter armature by an auxiliary magnet to a greater or less extent, according to the load on the circuit.

796,067. ELECTRIC METER; Thomas Duncan, Lafayette, Ind. App. filed Feb. 26, 1904. A magnetic suspension for the movable part of a meter comprising an iron disc in proximity to a magnet thereabove. A jewel-bearing takes the upward thrust.

796,068. ELECTRIC METER; Thomas Duncan, Lafayette, Ind. App. filed Feb. 26, 1904. Relates to a means for preventing the action of lightning upon the armature circuit. Employs inductance coils in close proximity to ground connections so that lighting discharges are caused to encounter impedance.

796,069. ELECTRIC METER; Thomas Duncan, Lafayette, Ind. App. filed July 13, 1904. A construction of brush which is axially revolvable so as to adjust new surfaces into contact with the meter commutator.

796,070. THREE-WIRE METER; Thomas Duncan, Lafayette, Ind. App. filed Oct. 10, 1904. A special construction of meter having two field coils in the different branches of the three-wire circuit and a single armature wound with two coils in shunt across the two branches of the three-wire circuit.

796,089. TELEPHONE-EXCHANGE APPARATUS; Elias E. Ries, New York, N. Y. App. filed May 20, 1904.

796,100. ELECTRIC CABLE; Charles E. Wilson, Philadelphia, Pa. App. filed Apr. 8, 1903. The cable has an iron core with two longitudinal grooves on the surface thereof. The telephone line wires are carried in these grooves. The effect is to dissipate capacity charges and to increase the magnetic inductance so that the usual relay induction coils ordinarily used at periodic intervals are made unnecessary.

796,114. ELECTROTHERAPEUTIC APPARATUS; Herschel E. Currey, Baker City, Ore. App. filed June 14, 1905. A cup designed to be applied to the body has means for exhausting the air therefrom. The cup has a separate chamber for x-ray discharges, which are more effective on the surface of the body which is surcharged with blood by the vacuum.

796,146. POWER BRAKE; Louis Pfingst, Boston, Mass. App. filed Oct. 24, 1904. A brake lever is located at the base of the usual controller and is affected to throw a friction clutch which connects the brake applying means to a power connection from the electric motor.

796,254. PHOTOPHONE; Bruno Saenger, Berlin, Germany. App. filed Sept. 15, 1904.

796,259. ELECTROMAGNETICALLY OPERATED RECIPROCATING TOOL; Harry S. Sherman, Denver, Col. App. filed Apr. 22, 1904. The solenoid coils are wound so as to leave a free circulation between the windings, and the whole is surrounded with oil which constitutes the insulating medium.

796,269. PIPE CAP FOR OUTDOOR WIRING; Wheeler H. Vibber, New London, Conn. App. filed Mar. 20, 1905. A cap for protecting wires within the vertical iron pipes ordinarily used in exterior wiring. The cap has a downwardly directed orifice through which the wires issue.

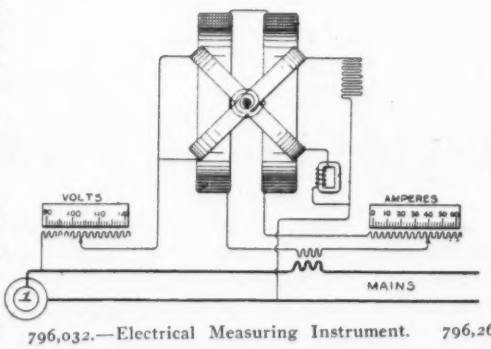
796,287. ELECTRICALLY CONTROLLED SHIFTING SYSTEM FOR TRACK SWITCHES; Thomas Bovey, Chicago, Ill. App. filed July 11, 1904. The track switch has a pair of separate motor magnets, the circuits of which are alternately completed by the motions of the switch point. For either position of the switch point that magnet is energized which tends to move the point to the opposite position, so that the switch point moves alternately.

796,295. COMBINED BRAKE AND TAKE-UP MECHANISM FOR TROLLEYS; Henry B. Clarke, Chicago, Ill. App. filed July 9, 1904. The trolley cord is deflected by guiding pins on a lever which controls an air brake. A very abrupt movement of the lever sets the air brake and holds the cord against movement, while a moderately abrupt movement applies a lesser braking force.

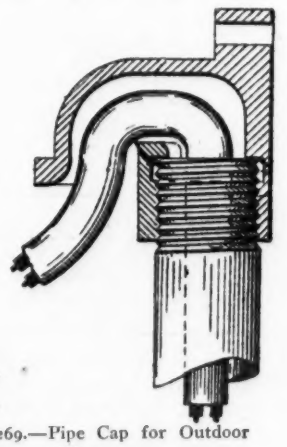
796,296. TROLLEY RETRIEVING DEVICE; Henry B. Clarke, Chicago, Ill. App. filed Oct. 31, 1904. A spring impelled gear for retrieving the trolley is normally held inactive by a magnet energized through the trolley circuit. When the trolley leaves the wire the magnet is deenergized and the retriever thrown into operation.

796,297. AUTOMATIC RESTORING THERMAL PROTECTOR; Frank B. Cook, Chicago, Ill. App. filed Dec. 9, 1904. A thermal protector in which the revoluble element is normally held stationary by a heat susceptible material, which is softened when the coil receives an excessive current. The parts automatically re-solder themselves into the new position and can be returned to their normal or operative relation by a form of friction ratchet which engages only in one direction.

796,312. APPARATUS FOR THE REDUCTION OF IRON-SAND, IRON OXID AND OTHER SUITABLE SUBSTANCES; David Ranken Shirreff Galbraith, Auckland, New Zealand. App. filed Oct. 27, 1903. (See page 272.)



796,032.—Electrical Measuring Instrument.



796,269.—Pipe Cap for Outdoor Wiring.

796,325. STOPPER FOR ELECTROLYTIC POTS CONTAINING FUSED BATHS; Charles M. Hall, Niagara Falls, N. Y. App. filed April 30, 30, 1902. (See Page 272.)

796,343. ELECTRIC GAS LIGHTER; Joseph Mlada, Manitowoc, Wis. App. filed Jan. 2, 1904. Attached to the ordinary gas cock is an arm which moves to make a sparking contact above the burner when the gas cock is turned.

796,360. ELECTRIC SWITCH; Joseph H. Rusby, Nutley, N. J. App. filed June 1, 1904. A wall switch having a pair of buttons which move the switch arm in opposite directions. A cam roller is effective to hold the switch arm at either extreme position of its movement.

796,368. MOTOR-METER; Charles P. Steinmetz, Schenectady, N. Y. App. filed Nov. 21, 1896. (See Current News and Notes.)

796,378. APPARATUS FOR MAKING ARMORED CABLES; Marcus M. Waterman, Troy, N. Y. App. filed Jan. 28, 1905. The cable is led between three rotating grooved rollers which guide a pair of binding wires thereto in such a way that the wires interlock together.

796,403. ELECTRIC-WAVE-TELEGRAPH RECEIVER; Charles L. Fortier, Milwaukee, Wis. App. filed April 17, 1903.